



1977

Passive Use of the Radio Spectrum for Scientific Purposes and the Frequency Allocation Process

George J. Alexander

Santa Clara University School of Law, gjalexander@scu.edu

Mark A. Stull

Follow this and additional works at: <http://digitalcommons.law.scu.edu/facpubs>



Part of the [Law Commons](#)

Automated Citation

George J. Alexander and Mark A. Stull, *Passive Use of the Radio Spectrum for Scientific Purposes and the Frequency Allocation Process*, 43 J. AIR L. & COM. 457 (1977),

Available at: <http://digitalcommons.law.scu.edu/facpubs/648>

This Article is brought to you for free and open access by the Faculty Scholarship at Santa Clara Law Digital Commons. It has been accepted for inclusion in Faculty Publications by an authorized administrator of Santa Clara Law Digital Commons. For more information, please contact sculawlibrarian@gmail.com.

PASSIVE USE OF THE RADIO SPECTRUM FOR SCIENTIFIC PURPOSES AND THE FREQUENCY ALLOCATION PROCESS

DR. MARK A. STULL*

GEORGE ALEXANDER**

INTRODUCTION

AMONG the most pliant of the natural resources exploited by technological man is the radio spectrum. Broadcasting, two-way communications of diverse kinds, data transmissions, and radar illustrate some of the uses of this resource which have become so entwined in the fabric of everyday life and commerce that modern society is inconceivable without them. Worldwide telecommunications investments are so vast as to be virtually uncounted, and the amount is increasing rapidly. Yet, the radio spectrum is a unique kind of resource. It is capable of use by all, but it is functionally finite. If there are more than a certain number of users, they will cause intolerable interference with one another. To avoid such interference a complex system of regulation has been created in the United States and internationally. While frequency-management agencies have done a remarkable job in coping with a nearly impossible task, the continuing explosive growth of demand for the use of radio frequencies now threatens to saturate the spectrum.

This article focuses on passive radio spectrum users who conduct scientific studies of radio signals generated by non-human agencies. At present there are three categories¹: radio astronomers

* J.D., 1978, Univ. of Santa Clara; Ph.D., 1971, Univ. of Mich.; M.A., 1967, Univ. of Kan.; B.A., 1965, Brown Univ.

** J.S.D., LL.M., 1969 and 1965, Yale Univ.; J.D., A.B., 1958 and 1953, Univ. of Pa. George Alexander is Dean and Professor of Law at Univ. of Santa Clara.

¹ See Radio Regulations of the International Telecommunication Union, art. I. (rev. by Final Acts of the World Administrative Radio Conference for Space Telecommunications, July 17, 1971, 23 U.S.T. 1527, T.I.A.S. No. 7435) [hereinafter cited as Radio Regulations]; Sagan & Drake, *The Search for Extraterrestrial*

who concern themselves with the study of naturally generated signals of cosmic origin; scientists who concern themselves with the study from space of naturally generated signals of terrestrial origin; and scientists engaged in the Search for Extraterrestrial Intelligence (SETI), which has as its goal the discovery of artificially generated signals of cosmic origin. These uses of the spectrum differ from all others in several important respects: 1) they transmit no signal of their own, but only receive signals generated by processes beyond human control; 2) the signals sought to be detected are thought to be extremely weak by normal telecommunications standards; 3) these signals may not be observed with equal convenience anywhere in the spectrum, but generally must be looked for at specific frequencies determined by the laws of nature; and 4) in an arena dominated by economic giants they are enterprises which earn no profit, involve no vast expenditures, produce no immediate product, and gain little publicity. Yet they are possessed of a social value which is both enormous and unique. Indeed, it would be no exaggeration to state that the passive scientific uses of the radio spectrum may ultimately provide the key to future progress and perhaps the very survival of the human race. Two possibilities, among many, serve to illustrate this point: the prospective discoveries of new laws of physics and of extraterrestrial civilizations at least as advanced as our own.

Radio astronomy discovered that galactic nuclei release an utterly fantastic quantity of energy in a volume of space perhaps no larger than that occupied by our own solar system. This energy release² actually exceeds the combined thermonuclear energy generation of the thousands of billions of stars that constitute a galaxy like our own Milky Way, which is one hundred thousand light years³ across.⁴ A growing number of physicists suspect that it can only be explained by the operation of still undiscovered laws of physics. Since we believe that intense gravitational fields can inter-

Intelligence, 232 SCIENTIFIC AMERICAN 80 (1975) [hereinafter cited as Sagan & Drake].

² See Burbidge, *The Nuclei of Galaxies*, 8 ANN. REV. ASTRON. & ASTROPHYS. 369 (1970).

³ A light year is a measure of distance, and one light year is the distance that light travels in a year. Since the speed of light is 186,000 miles per second, one light year is equal to approximately 6,000,000,000,000 miles.

⁴ C.W. ALLEN, *ASTROPHYSICAL QUANTITIES* 282 (3d ed. 1973).

act with matter to produce huge amounts of energy, and since our present understanding of gravity is clearly incomplete, these laws would probably be new theories of gravitation.⁵ Discovery of such laws could provide the key to new technologies presently as unimaginable as computers, lasers, and nuclear power were a century ago. The beneficial impact is as impossible to foresee as was the impact of the development of the printing press. It is conceivable that the ability to create and control local gravitational fields could make possible the conversion into energy of the entire rest mass of ordinary rock. Given such great amounts of energy we could build vast orbiting space farms to grow as much food as we willed, move our heavy-polluting industries to airless planets where they would do no harm, transmute one element into another at will, and terraform Mars, Venus, and other planets to make homes for our surplus population. Fantastic though this sounds, it may well be what the future holds. Should it come to pass, it is more than likely that we will owe part of our good fortune to the interception and interpretation of a radio signal falling upon the Earth from deep in space.

The second possibility, that the immediate future will see mankind's first contact with intelligent extraterrestrial life,⁶ is of no less consequence than the first. We understand the origin of our planetary system and the subsequent development of living organisms on Earth sufficiently well to require us to believe that life-bearing planets must be very common in our galaxy. Probably hundreds of thousands of these planets have already evolved civilizations more advanced than our own.⁷ It is not impossible that some of these have learned how to travel over the vast distances between the stars, perhaps using physical laws of which we yet know nothing. Whether this be true or not, it will certainly be economical for them to communicate with one another by sending out radio signals.⁸ It may be possible that a few have developed a sufficiently high degree of altruism that they have deliberately sent out mes-

⁵ See C. MISNER, K. THORNE, & J. WHEELER, *GRAVITATION* (1973).

⁶ See Sagan & Drake, *supra* note 1; I.S. SHKLOVSKII & C. SAGAN, *INTELLIGENT LIFE IN THE UNIVERSE* (1966); *INTERSTELLAR COMMUNICATIONS: SCIENTIFIC PERSPECTIVES* (Ponnamperuma & Cameron, eds. 1974).

⁷ See references cited note 6 *supra*.

⁸ *Id.*

sages designed to be intercepted by and helpful to an emerging technological civilization with all the problems we currently face.⁹

These are not the only kinds of signals we can possibly expect to discover emanating from an extraterrestrial civilization. We can anticipate that we may detect signals generated for purposes other than interstellar communication, but inadvertently broadcast into space, and it is important that we try to do so. In just this manner we are broadcasting our presence to any who may be listening. For twenty years or more our television stations and aircraft acquisition radars have been broadcasting radio signals so powerful that they overwhelm those naturally generated by the Sun.¹⁰ At our present level of technology we are quite capable of building equipment which could detect signals of strength comparable to those produced by strong terrestrial transmitters at a distance of hundreds of light years. It must be assumed that any nearby advanced civilization will become aware of us as soon as the signals we have sent out reach them. What attitude such a civilization might take toward us cannot be predicted,¹¹ but it is not impossible that within the lifetime of readers of this article, or that of their children, Earth might be visited by a ship from the stars. The importance of searching for radio signals from extraterrestrial civilizations needs no more emphasis than this.

It will probably not surprise the knowledgeable reader to find that science is far ahead of law in this field and that the law does not expressly address passive radio reception. United States telecommunications law is embodied almost entirely in the Communications Act of 1934,¹² which superseded the Radio Act of 1927,¹³ incorporating most of its provisions. Under the 1934 Act, the radio spectrum is placed under the control of the United States, and the possibility of private ownership of any frequency or band of frequencies is absolutely precluded.¹⁴ The Act also provides that essentially no radio signals (other than those broadcast by the

⁹ *Id.*

¹⁰ Sagan & Drake, *supra* note 1.

¹¹ Michaud, *Interstellar Negotiation*, 49 FOREIGN SERVICE J. 10 (1972).

¹² 47 U.S.C. §§ 151-606 (1970 & Supp. V 1975). The other major United States telecommunications statute is the Communications Satellite Act of 1962, 47 U.S.C. §§ 701-44 (1970).

¹³ Radio Act of 1927, ch. 169, 44 Stat. 1162.

¹⁴ 47 U.S.C. § 301 (1970).

Federal government) may be transmitted within the United States, its territories, and possessions, or from any vessel, aircraft, or other mobile station subject to the jurisdiction of the United States, without a license from the Federal Communications Commission;¹⁵ moreover, it establishes criteria for license applicants¹⁶ and reserves to the President the power to assign frequencies to government radio stations.¹⁷ The Act contains no authority for the FCC or the President to regulate the strictly passive reception of radio signals.¹⁸ Nevertheless, strictly passive reception of radio signals of non-human origin is possible only at the sufferance of the FCC and the President. This is a consequence of the fact that, independent of the frequency at which they occur, these signals are intrinsically so weak that they may be detected only with the most sensitive receiving equipment modern technology can build. They will be masked and rendered entirely undetectable by many kinds of transmissions broadcast with power sufficient to be received by ordinary and inexpensive equipment. There is great demand for licenses to transmit by a vast multitude of spectrum users, and thus, if passive studies of radio signals of non-human origin are to be possible, there must be an allocation of those frequencies where such studies may be made, so that licenses to transmit will be denied to all applicants whose broadcasts would interfere.

The licensing of radio-spectrum users has developed as a two-step process: allocation and assignment.¹⁹ Radio-frequency allocation consists of the dividing of the entire radio spectrum into a number of frequency bands which are individually reserved to different classes of users. For example, the band from 21.45 to 21.75 MHz is among the bands reserved to broadcasting,²⁰ while the band from 21.00 to 21.45 MHz is among those allocated to use by amateurs.²¹ Once a band has been allocated to one or more classes of users, individuals in that class may apply for and be granted a license to use a particular frequency within that band.²²

¹⁵ *Id.*

¹⁶ *Id.* §§ 303, 307-11 (1970 & Supp. V 1975).

¹⁷ *Id.* § 305 (1970).

¹⁸ *Id.* §§ 301, 303 (1970 & Supp. V 1975).

¹⁹ *Id.* § 303(c) (Supp. V 1975).

²⁰ 47 C.F.R. § 2.106 (1976).

²¹ *Id.*

²² 47 U.S.C. § 303(c) (Supp. V 1975); 47 C.F.R. § 2.102(a) (1976).

This is the assignment process. Thus an amateur may be assigned a license to transmit at 21.25 MHz or at some other frequency in the 21.00 to 21.45 MHz band, but not at 21.55 MHz which is the band allocated for broadcasting; an aircraft radar may not be assigned a frequency in either band.

The allocations process is exceedingly complex. In the first place, there is an international allocations procedure, whereby a set of Radio Regulations²³ is agreed to by the member countries of the International Telecommunications Union (153 members in 1977). These Radio Regulations, which are revised every several years, include a table of frequency allocations which reserves individual frequency bands to specific classes of users, called services, for the purpose of preventing harmful interference to the reception of radio signals by one nation as a result of radio signals transmitted by any other nation. They are negotiated for the United States by the Department of State, are accorded the status of a multilateral treaty, and are submitted for ratification to the Senate.²⁴ Insofar as strictly domestic frequency management is concerned, the Communications Act of 1934 gives power to license frequency use and to allocate frequency bands to the FCC, but section 305 reserves to the President the power to assign frequencies to government radio stations.²⁵ He, in turn, has delegated his authority to the Office of Telecommunication Policy²⁶ (OTP) in the Executive Office of the President, by Reorganization Plan²⁷ subject to Congressional disapproval, and by executive order.²⁸ Thus both the FCC and the OTP have authority to allocate the entire radio spectrum, while in practice actual United States frequency allocations

²³ Radio Regulations, *supra* note 1.

²⁴ See, e.g., Partial Revision of Radio Regulations, Nov. 8, 1963, 15 U.S.T. 887, T.I.A.S. No. 5603.

²⁵ 47 U.S.C. § 305 (1970).

²⁶ Exec. Order No. 11,556, 3 C.F.R. 283 (1974) (as amended by Exec. Order No. 11,921, 41 Fed. Reg. 24,294 (1976)).

²⁷ Reorganization Plan No. 1 of 1970, 35 Fed. Reg. 6421 (1970), *reprinted in* 84 Stat. 2083 (1970).

²⁸ As of the time of writing, there is speculation that President Carter may abolish the OTP and delegate its authority to some other agency, as part of his intended reorganization of the Federal Government. We wish to emphasize that our discussions of the powers of the OTP are based on the authority conferred upon the President by statute. A mere redelegation of that authority would change none of our essential conclusions.

closely follow the International Radio Regulations, which are negotiated by the State Department. It is a remarkable fact that, despite this patent conflict of authorities, of the vast number of disputes concerning radio spectrum usage which have been litigated, essentially every one has been concerned with the assignment of a frequency license to an individual user. Almost none has been concerned with the allocation of frequency bands to services. Nevertheless, we feel that allocation, especially with respect to the passive services, raises a number of interesting legal issues which merit discussion.

The approach we adopt is first to explore the general nature of rights in the radio spectrum and to consider the operation of the specific federal agencies which have been set up to administer these rights. We then consider how frequency management by those agencies is impacted by international spectrum usage treaties to which the United States is a party. At that point we will hopefully have established an appropriate foundation for the consideration of the standards, established by statute and by judicial decision, which govern frequency allocations to all spectrum users. We then examine in detail the application of these standards to the allocation of frequency bands to the passive services and to protection of those services against interference from users who have been allocated different bands. Our discussion leads to the conclusion that their special nature requires that they be treated differently from other telecommunications services. In particular, we argue that the statutes and case law imply there are circumstances where there should be preferred allocations of particular frequency bands to the passive services. Finally, we explore the remedies available to the passive services in the event of adverse agency action.

Before launching our legal study, however, it may be useful to engage in a very approximate and elementary discussion of the physics of radio waves in order to ensure understanding of the technical terms which must be used in this paper and to make clear that there are physical characteristics of radio signals, about which man can do nothing, which place important constraints on radio spectrum management. The technically oriented reader will probably desire to skip to Section III, The Frequency Allocation Process.

II. THE PHYSICS OF RADIO SIGNALS

In general, radio waves are a kind of electromagnetic radiation, or light, as it is commonly called, which, along with infrared and ultraviolet radiation, x-rays and gamma-rays, fall outside the frequency range to which the human eye is sensitive. The generation of all kinds of electromagnetic radiation is understood today in terms of the highly mathematical laws of relativistic quantum-field physics. However, it is possible to explain it in lay terms, which, though crude and greatly over-simplified, will present a picture that is not seriously incorrect.

Any electric charge produces electric and magnetic fields which exert a force on any other electric charge, which may be located some distance away. This force will cause the other electric charges to change over a period of time their state of motion (their speed, which may have initially been zero, their direction, or both). If the first electric charge is somehow caused to vary the speed or direction of its own motion, the field it generates, and hence the forces which that field exerts on the other charges, will change. However, this field, which pervades all space outward from the charge to very great distances, does not change instantly over its whole extent; rather the charge propagates outward from the charge with the speed of light, approximately 186,000 miles per second. Thus other charges will feel the effect of the changed field only after the passage of a certain period of time following the change in velocity of the first charge, and the length of this time delay will be equal to their distance from the charge divided by the speed of light.

Imagine that we generate an electric current and cause it to flow through a simple wire circuit between two terminals of a generator. An electric current is nothing but a collection of moving electric charges, and its strength depends on the number of charges which cross any point in the wire per unit interval of time. Thus if we imagine that there is a dial on the generator which can be turned to control the number of charges flowing through the wire, we can cause the current to increase or decrease at will. Suppose that initially there is no current flowing through the wire, and we first turn the dial on the generator slowly so that the current in the wire increases to its maximum strength. Then, suppose we turn

the dial the other way so the current decreases again to zero, but do not stop there. Let us turn the dial so the current begins to increase again. Finally, let us continue turning the dial back and forth. What is the effect of all this? The electric charges of which the current is composed will be caused to move through the wire, and the strength of the current will always be changing. Clearly these charges generate electric and magnetic fields, as our single charge did before, and the strength of these fields will change in proportion to the changes in the current. Since the current changes in a continuous and periodic fashion, the fields will also change continuously and periodically, but those changes will take time to propagate out to points distant from the wire. Thus the electric and magnetic fields around the wire would appear, if we could see them, to be changing their strength in a wave-like manner. If we draw an analogy between the strengths of our fields and the level of the sea, what we observe would look exactly like the ocean waves with which everyone is familiar. Each wave in the strengths of the fields would consist of a crest, at which the fields are strongest, followed by a trough, at which the fields are weakest; these crests and troughs would move outward from the wire at the speed of light. It is these wave-like changes in field strengths that we call electromagnetic radiation.²⁹

These electromagnetic waves have certain characteristics that can be understood by anyone who has watched the ocean crash upon the beach. The height of a wave, or vertical distance from its crest to its trough, is called its amplitude, and, for our electromagnetic waves, depends upon the maximum strength of the current in our wire. If we move the dial back and forth over only small distances, we will produce waves of small amplitude; rotating the dial over large distances will produce waves of large amplitude. Furthermore, we can produce waves as rapidly or as slowly as we want by spinning the dial rapidly or slowly. The rate at which we produce waves is called the frequency of the radiation; it can be measured by counting the number of wave crests (or troughs) that pass a given point each second. One wave, or cycle, per second, is

²⁹ Actually any change in electromagnetic field strength which propagates through space is considered to be electromagnetic radiation and can be described mathematically as wave-like in form. See generally HOYLE, *ASTRONOMY AND COSMOLOGY: A MODERN COURSE* PT. II (1975); J.D. KRAUS & K.R. CARVER, *ELECTROMAGNETICS* (2d ed. 1973) [hereinafter cited as KRAUS & CARVER].

called one Hertz, in honor of a nineteenth century physicist who contributed greatly to our understanding of electromagnetic phenomena; the Hertz will be used throughout this paper to denote the fundamental unit of measure for frequency. One other parameter describing electromagnetic radiation is the wavelength; this is the distance between successive wavecrests or wavetroughs. The product of the wavelength and the frequency is equal to the speed of the waves, which is the speed of light. Radio waves are electromagnetic waves with frequencies below several hundred billion Hertz;³⁰ the radio spectrum has been allocated in the United States over the entire frequency range between 10 KHz and 275 GHz.³¹

Electromagnetic waves carry energy, and it is this property which makes them useful, for we can extract that energy and do work with it. For example, if there is a second wire at some distance from our first, electromagnetic waves which cross it will produce changes in the motions of the charges in it. These changes are identical to the acceleration of surrounding electric charges caused by the acceleration of a single charge that we discussed above. Such induced charge motions in the second wire are nothing but an electric current, the strength of which can be measured. Recall that by varying the rate at which we spin the dial of our generator, we can vary the wave-frequency, and by changing the amount by which we turn it, we can change the wave-amplitude. Thus we can modulate either the amplitude or frequency of any electromagnetic wave we generate in any manner we choose, and measure these modulations with an appropriate receiver, such as our second wire, at some distance away. In particular, we can code the modulations to carry a message which we can then decipher. Crudely, this

³⁰ One billion Hertz is called one gigahertz (abbreviated GHz); one million Hertz, one megahertz (MHz); and one thousand Hertz, one kilohertz (KHz).

³¹ Higher frequencies than this are included in what is called the infrared, while frequencies of visible light lie in the range 400 to 800 thousand GHz, and waves of still higher frequency are called ultraviolet rays, x-rays, and gamma rays. The upper limit of allocated frequencies has been increased as technologies to transmit and receive at higher frequencies have been developed; in 1937 this limit was but 300 MHz. (For a short history of frequency allocations see Note, *The Crisis in Electromagnetic Frequency Spectrum Allocation: Abatement Through Market Distribution*, 53 IOWA L. REV. 437 (1967) [hereinafter cited as Note, *The Crisis in Electromagnetic Frequency Spectrum Allocation*]).

describes the basic principle of radio communications.³³ It remains only to point out a few very important characteristics of this process.

Just as it is possible to transmit at any desired frequency, it is also possible to design a receiver which will be sensitive to waves with a certain frequency. This statement must be somewhat qualified, however. Any transmitter will produce radiation over a range of frequencies (called the bandwidth of the signal) with essentially the same power (which is proportional to the amplitude of the wave, squared) at each frequency in the range.³⁴ This is true for a number of reasons. For instance, in our simplified example of a wire attached to a generator, the electrons which constitute the current flowing through the wire will run into each other and the various atoms which make up the wire; this means the fields they individually produce will change at different rates, and the emitted radiation will therefore cover a band of frequencies. As a practical matter it may or may not be desirable to produce a signal with a wide bandwidth. What is of crucial importance from the standpoint of regulating spectrum use, however, is the fact that, for reasons of physics outside the scope of this article, if one attempts to generate a signal at one frequency, one will in fact generate signals at all frequencies, although the power of the signals at frequencies far outside one's intended bandwidth will be very much less than at frequencies within it. But the power as a function of distance does not fall off continuously. There are special frequencies, called harmonics, which occur at integer multiples of the fundamental frequency, where the power in the signal will be quite large—indeed, it is possible in some physical situations to produce harmonics with power comparable to that at the fundamental frequency.

This, of course, is of major consequence to radio spectrum usage. If the FCC licenses a television station to transmit at 750 MHz, but has not allocated frequencies above 806 MHz to television, then, as a consequence of the physical laws governing radiating systems, that station will not only produce weak signals at all fre-

³³ The familiar designations AM and FM refer to coding by amplitude modulation and frequency modulation respectively. See generally KRAUS & CARVER, *supra* note 29.

³⁴ See generally KRAUS & CARVER, *supra* note 29, chs. 13, 14.

quencies both above and below 806 MHz, but it will also produce potentially strong signals at 1500, 2250, and 3000 MHz, and the power in these signals will be very great indeed where the transmitter in question is intrinsically as powerful as a television station. This unavoidable out-of-band radiation is referred to as spurious radiation. It cannot be eliminated entirely, but it can be reduced in power to almost any level desired, by appropriate measures such as the use on transmitters of filters, which act electrically to decrease power at out-of-band frequencies before the radiation leaves the transmitter. To do this costs money, however, and the lower a spectrum-user is required to keep the power in his harmonics and other spurious radiation, the more it will cost him. A very important task of the FCC and OTP is to set maximum permissible power limits for spurious radiation; such standards are set by the International Radio Regulations as well.

The power received at a given location from a specific transmitter depends not only on the power radiated by the transmitter, but also on one's distance from it. The power carried by any light wave, radio waves included, falls off as the square of the distance from its origin. Thus it is possible to license two transmitters at the same frequency without the danger that they will harmfully interfere with one another if they are separated by sufficient distance that the power in the respective transmitted signals has decreased to a level too low to be noticed after they have crossed this distance. Furthermore, radiation propagates only in a straight line, while the Earth is curved. Thus, if one site is below the horizon as seen from another, radiation transmitted from one of the sites will not ordinarily be expected to reach the other. It is for this reason that signals intended to be received a large distance away must be transmitted from atop a very high tower or from one relay station to another. The atmosphere can act to scatter radiation, however, and this results in a small fraction of the transmitted power being able to reach sites below the transmitter's horizon. Advantage is sometimes taken of this fact to transmit over long distances by using very high power transmitters and avoiding the expense of building relay stations; on the other hand, it is obviously possible for powerful transmitters inadvertently to cause harmful interference to someone, though he be over the horizon,

even at considerable distance. Moreover, just like visible light, radio waves can be reflected from objects which they strike. Reflection off aircraft, and even space satellites and debris, can cause a signal to fall at a point over the horizon far from its origin, and, if it had enough power initially, to cause harmful interference there. Indeed, at very low frequencies, the Earth's ionosphere, a region high in the atmosphere which contains charged particles, reflects radio waves, and commercial radio broadcasting makes use of this to deliver signals to home receivers. As might by now be guessed, the propagation characteristics of the atmosphere not only vary with radio-wave frequency, but also with its temperature, moisture content, and other weather conditions, especially at high frequencies where water vapor becomes a strong radio-wave absorber.

Finally, we note that it is possible to design antennas³⁴ which can beam radiation generated by a transmitter primarily into a relatively narrow cone in one direction or which can receive radiation primarily from a similar narrow cone. However, it is a general characteristic of such antennas that they transmit signals at some power level in all directions and also receive signals from all directions. The factor by which an antenna can increase the power that would be put out by the transmitter alone radiating in all directions is called its on-axis gain; the factor by which the power radiated in directions other than along the axis is increased or decreased over that broadcast by the transmitter is called its off-axis gain. A typical large antenna may have an on-axis gain of a million or more, which falls rapidly to unity at distances of ten to twenty degrees off-axis, while the off-axis gain at a distance from the axis of 90 degrees is typically around 0.01. The off-axis gain, however, never falls to zero, even behind the antenna. By making it possible to focus transmitted radiation and to amplify received radiation coming primarily from one direction, antennas make possible the use of lower transmitter powers. They decrease possibilities for harmful interference even further by reducing the signal power transmitted in the direction of other spectrum users who are located at large angles to the line of the antenna-axis.

The need for regulation of radio communication arises because of the characteristics of electromagnetic radiation. In what follows,

³⁴ *Id.* ch. 14.

we will try to avoid discussions of physics as much as possible, but it is essential to remember that, in the telecommunications area especially, human law must be subservient to the laws of nature.

III. THE FREQUENCY ALLOCATION PROCESS

A. The Nature of Rights in the Radio Spectrum

Before examining the detailed relation between the FCC, OTP, and State Department, it will be useful to consider briefly the nature of the right that the recipient of a frequency assignment acquires. What is ordinarily meant by the term "spectrum" is the aggregation of all possible frequencies which any electromagnetic wave may have. But a frequency is not even a tangible physical entity; it is merely the number of wave crests that pass a given point per unit interval of time. Both man and nature can generate an electromagnetic wave which has any particular frequency, but, that is not a possessory act with respect to that frequency,³⁵ nor does it bar another from transmitting waves at the same frequency. However, two such waves at the same physical location will interfere with one another and become useless for telecommunications purposes since it will have become impossible to receive them individually. Human creativity has little hope of devising a technology which can make this otherwise; the problem is essentially equivalent to that of removing from the Mississippi River just that water which has flowed into it from the Ohio.³⁶

Thus by a strictly physical argument it can be seen that importance attaches only to the exclusive right to generate electromagnetic waves at a given frequency and in a particular locality. While the possession of material objects must be contemplated according to the principles of personal and real property law, the award of exclusive rights to selected members of a society need be governed by no such considerations. United States telecommunications statutes have recognized this from the beginning. The

³⁵ It may, however, be a possessory act with respect to the wave, since the wave is a physical entity, and to create something could be considered an exercise of dominion or control over it. But once generated, electromagnetic waves, by their nature, immediately begin to travel and are no longer significantly subject to human control.

³⁶ See generally KRAUS & CARVER, *supra* note 29.

Radio Act of 1927, and subsequently the Communications Act of 1934, encoded into law the principle of physics that radio frequencies may not be possessed; this has not changed in the years since. It is possible to acquire only a right to transmit at some frequency for a limited period of time under a license granted by Federal authority, and that right is subject to such terms and conditions as may be imposed.³⁷ That one may not acquire property rights in the electromagnetic spectrum but may only receive a revocable license to transmit at a given frequency carries with it the corollary that revocation of such license gives rise to no fifth amendment issue of compensation for taking of property. This is important, since telecommunications is a multi-billion dollar industry. Although licenses for frequency-use are not awarded in exchange for value, the recipient of a license may invest huge sums of money in transmitting and receiving equipment. He thereby acquires a very real economic interest in keeping his license, but this economic interest would not be compensated should that license be revoked.

This was established as the correct interpretation of the law by judicial decision following passage of the Radio Act and remains so under the Communications Act. In *American Bond & Mortgage Co. v. United States*,³⁸ appellant's license had been revoked by the Federal Radio Commission for no other reason than to reduce interference. Appellant had expended over \$100,000 in building its radio station and claimed that it was entitled to compensation for a taking of property. This claim was denied. Appellant's property was not taken. It retained its station and all equipment located therein and could sell them to any buyer it could find,

³⁷ 47 U.S.C. § 301 (1970) provides:

It is the purpose of this chapter . . . to maintain the control of the United States over all the channels of interstate and foreign radio transmission; and to provide for the use of such channels, but not the ownership thereof, by persons for limited periods of time, under licenses granted by Federal authority, and no such license shall be construed to create any right, beyond the terms, conditions, and periods of the license.

Nearly identical language formerly appeared in the Radio Act of 1927, ch. 169, 44 Stat. 1162.

47 U.S.C. §§ 304, 309(h) also bar the acquisition of a vested interest in any frequency by a licensee. *Accord*, *Aschbaker Radio Corp. v. FCC*, 326 U.S. 327 (1945).

³⁸ 52 F.2d 318 (7th Cir. 1931).

though perhaps for less than what it paid. All it lost was a right which was granted subject to certain conditions, including that it might be revoked to reduce interference. Certainly this right was valuable, and revocation of its license apparently brought appellant financial loss. Yet appellant must have known it ran this risk when it first sought the license. An applicant who accepts a government permit which is subject to certain conditions "cannot later assert rights which were surrendered in order to secure the permit."³⁹

This principle is especially important when the passive scientific services are considered. Given the nature of scientific discovery, it may be realized tomorrow that there exists signals, of great importance to the advancement of learning, in a frequency band which yesterday was thought to be without scientific significance. Indeed, this has happened many times in the past twenty years.⁴⁰ Today, equipment investments are so large that users of a frequency may wish to claim a right to compensation should their further use of it be barred by a reallocation to a passive service. But to this they are not entitled.⁴¹

B. Spectrum Management by the FCC and the OTP

As has already been noted, both the FCC and the OTP have power to allocate the entire frequency spectrum, the former to private and commercial users and the latter to government agencies. It is the purpose of this section to survey critically the law under which this dual authority has been allowed to develop. We shall see that dual authority may compromise the ability of the FCC to fulfill its congressional mandate; we fear that this especially jeopardizes the rights of economically weak spectrum users, such as the passive services.

The Communications Act explicitly mandates that the FCC is to define classes of spectrum users,⁴² allocate specific bands of frequencies thereto,⁴³ and assign frequencies within the allocated bands, and only within these bands, to individual members of

³⁹ *Id.* at 320; see also *Capital Tel. Co. v. FCC*, 498 F.2d 734 (D.C. Cir. 1974).

⁴⁰ See, e.g., Moran, *Radio Observations of Galactic Masers*, in *FRONTIERS OF ASTROPHYSICS* (E. Avrett ed. 1976).

⁴¹ See e.g., *American Bond & Mortgage v. United States*, 52 F.2d 318 (7th Cir. 1931).

⁴² 47 U.S.C. § 303(a) (1970).

⁴³ *Id.* § 303(c) (Supp. V 1975).

these classes.⁴⁴ Moreover, the Act requires that neither frequency assignments⁴⁵ nor allocations⁴⁶ be made by whim or caprice, or at the subjective pleasure of the Commissioners, but defines a criterion which must be determinative of the merits of both: that the "public interest, convenience, or necessity" be served. It is a standard that is referred to many times throughout the Act, and it is clear that Congress intended the entire field of radio spectrum management to be impressed with it.⁴⁷ Although frequency-allocation problems have seldom given rise to litigation, frequency-assignment disputes have resulted in a copious supply⁴⁸ of judicial decisions interpreting what is meant by "public interest, convenience, or necessity." The Communications Act, however, does more than merely recite that public interest, convenience, or necessity are to govern radio spectrum usage. It makes several statements of public policy which delimit that standard and restrict its interpretation, if the Act be read self-consistently as a whole.

Paramount is the policy implicit in section 301(f) which gives to the Commission power to "make such regulation not inconsistent with law as it may deem necessary to prevent interference between stations."⁴⁹ It was the need to halt interference between unregulated broadcast stations operating on the same frequency which gave rise to the Radio Act of 1927. This Act was incorporated largely unmodified into the Communications Act, and the importance of preventing interference was recognized by the earliest judicial decisions in this area.⁵⁰ Indeed, it is essential to keep in mind that

⁴⁴ *Id.*; 47 C.F.R. § 2.102(a) (1976).

⁴⁵ 47 U.S.C. § 303 (1970 & Supp. V 1975).

⁴⁶ *Id.* §§ 303, 307(a).

⁴⁷ See *KFKB Broadcasting Ass'n v. Federal Radio Comm'n*, 47 F.2d 670 (D.C. Cir. 1931).

⁴⁸ See cases cited in Section V *infra*.

⁴⁹ 47 U.S.C. § 301(f) (1970).

⁵⁰ See *American Bond & Mortgage v. United States*, 52 F.2d 318, 322 (7th Cir. 1931):

The purpose of the federal regulation of radio broadcasting stations was obvious. The confusion which resulted from the uncontrolled operation of such stations was ruinous to all commercial enterprises engaged therein, as well as destructive of the benefit which the public enjoyed as a result of the development of the radio industry. There was but one effective method of regulation, to wit, through licensing of stations and the limiting of their use to specific wave lengths and to certain kilowatt power.

were it not for the physical fact that electromagnetic waves of the same frequency do interfere with each other, the generation of such waves by one individual could cause no harm to any other individual, and a congressional attempt to regulate this kind of activity would probably violate the first amendment.⁵¹ By the very laws of nature, if one individual is to have a right to transmit waves with a certain frequency which are to be capable of reception, another may not have that right. Individual frequencies being limited in number, the sharing of such rights among the members of society is properly a matter for a law-making tribunal. A system of frequency allocations or assignments which purports to divide rights to spectrum use among competing individuals for the public benefit but fails to prevent these individuals from interfering with each other is nothing more than a sham. Consideration of this fact is essential if interpretation of the provisions of the Communications Act is to serve any useful purpose; it will be especially relevant when we examine the need of the passive services to be protected against spurious radiation.⁵²

Authority for the FCC to regulate spurious radiation is explicitly granted by the Communications Act,⁵³ which also mandates to

⁵¹ Licensing necessarily and intentionally bars certain communications. The issue of whether the Communications Act is a restriction of freedom of speech that violates the First Amendment has been litigated, and the United States Supreme Court has upheld the Act. The essence of the justification for regulation is scarcity. *See, e.g., Red Lion Broadcasting Co. v. FCC*, 395 U.S. 367, 388-89 (1969):

Where there are substantially more individuals who want to broadcast than there are frequencies to allocate, it is idle to posit an unbridgeable First Amendment right to broadcast comparable to the right of every individual to speak, write, or publish. If 100 persons want broadcast licenses but there are only 10 frequencies to allocate, all of them may have the same "right" to a license; but if there is to be any effective communication by radio, only a few can be licensed and the rest must be barred from the airways. It would be strange if the First Amendment, aimed at protecting and furthering communications, prevented the Government from making radio communication possible by requiring licenses to broadcast and by limiting the number of licenses so as not to overcrowd the spectrum.

See also Lafayette Radio Elec. Corp. v. United States, 345 F.2d 278, 281 (2d Cir. 1965): "Here is truly a situation where if everybody could say anything, many could say nothing." *Accord, California Citizens Band Ass'n v. United States*, 375 F.2d 43 (9th Cir.), *cert. denied*, 389 U.S. 844 (1967).

⁵² *See* Section V *infra*.

⁵³ 47 U.S.C. § 303(e) (1970).

that agency the duty of increasing the efficiency of spectrum usage.⁵⁴ These are intimately related to each other, for the more stringent the limits which are imposed on spurious radiation, the closer together in frequency it will be possible for different users to operate without their spurious radiation causing mutual interference. Thus the available frequency spectrum can accommodate more users if they are all required to make extra expenditures to limit their spurious radiation, and this is an increasingly important consideration in an era of shortage of available spectrum space. Regulation of spurious radiation is not the only possible way of improving efficiency of spectrum usage, however; for example, the FCC can also mandate the use of highly directional antennas and set maximum power limits in order to increase the spatial density of non-interfering transmitters at each frequency.⁵⁵ Indeed, the Communications Act requires that all radio transmitters use the minimum amount of power necessary to carry out the communication desired.⁵⁶ In addition, the frequency allocation scheme itself, by placing services located in different geographical regions, or which operate typically at different times, in the same frequency band, can contribute greatly to maximizing efficiency of spectrum usage. The latter is no more than one element of the public interest, however, and the Act seems to contemplate that the FCC have at least some discretion to weigh it against other elements thereof. On the one hand, the public interest would be ill-served by a regulatory scheme which maximized the number of frequencies available for assignment but imposed such heavy economic burdens on their potential assignees as to make them unprofitable. On the other hand, neither could the public interest tolerate a scheme which minimized the economic burden on spectrum users but resulted in unnecessary diminution of the frequency channels available to them.

In addition, the Communications Act delimits the public interest by restricting the eligibility for a license of one who has violated the antitrust laws,⁵⁷ and by limiting the power of the FCC to license where a substantial lessening of competition or restraint of inter-

⁵⁴ *Id.* § 303(g).

⁵⁵ *Id.* § 303(c)-(f) (1970 & Supp. V 1975).

⁵⁶ *Id.* § 324.

⁵⁷ *Id.* § 313.

state commerce may result.⁵⁸ Furthermore, section 701(b) of the Communications Satellite Act⁵⁹ requires that communication satellite systems be planned with "attention . . . directed toward . . . efficient and economical use of the electromagnetic frequency spectrum"; this language is stronger than that contained in section 303(g) of the Communications Act⁶⁰ in that it appears to make efficient use of the spectrum a requirement for communication satellite systems, and not merely an element of the public interest to be weighed against other elements in regulating their use of spectrum space.⁶¹ Finally, just as various sections of the Communications Act define the meaning of "public interest, convenience, or necessity," so also do independent pieces of legislation when they express public policies which may be affected by frequency allocations and licensing; to maintain otherwise would be to imply that Congress has intended that statutes of the United States should work at cross purposes to one another. Indeed, the federal courts, which have the power of judicial review over FCC decisions,⁶² have approved and required the consideration by the Commission of diverse public policies, social benefits, and social harms in its formulation of the public interest.⁶³

The law is explicit and clear with respect to standards for the frequency management powers of the FCC. With respect to the same for the OTP, however, it is altogether vague. Historically,

⁵⁸ *Id.* § 314.

⁵⁹ 47 U.S.C. § 701(b) (1970).

⁶⁰ 47 U.S.C. § 303(g) (1970).

⁶¹ This interpretation is supported by the legislative history:

It is apparent that *over and above the national policy of operating the space satellites*, essential to a successful program is the efficient and effective allocation of the radio spectrum. The potential of any communications satellite system is conditioned by certain unalterable truths:

- (a) There is only one electromagnetic spectrum.
- (b) The spectrum is finite and uniformly distributed throughout the universe.
- (c) It is always and already distressingly crowded.
- (d) All telecommunications services, both present and potential, must use frequencies, and in a manner that does not interfere with other services.

S. REP. NO. 1587, 87th Cong., 2d Sess. 8, *reprinted in* [1962] U.S. CODE CONG. & AD. NEWS 2269, 2270 (emphasis added).

⁶² 47 U.S.C. § 402 (1970); Administrative Procedure Act, 5 U.S.C. §§ 701-706 (1970 & Act of Oct. 31, 1976 Pub. L. No. 94-574, 90 Stat. 2721).

⁶³ See Section V *infra*.

standard radio broadcasting was one of the first large-scale uses of the radio spectrum which developed,⁶⁴ and it was the proliferation of broadcast stations and the resulting chaotic interference situation which motivated Congress to pass the Radio Act of 1927.⁶⁵ Various agencies of the federal government had already long been operating their own radio stations, however, and, unlike private broadcasters, the government stations did make an attempt to regulate their frequency usage.⁶⁶ In 1922, the Interdepartmental Radio Advisory Committee (IRAC)⁶⁷ was formed primarily to advise the Secretary of Commerce on matters of common interest to radio users; however, it soon acquired as its primary function the coordination of assignments of frequencies to government radio stations. The IRAC, which is composed of representatives of all government agencies which use the radio spectrum, has retained this function up to the present day, in spite of numerous reorganizations of the frequency-management structure of the executive branch which have nominally, at least, subordinated it to other offices.⁶⁸ Since 1970 it has served in an advisory capacity to the Director of the OTP,⁶⁹ who has final authority to assign frequencies to radio stations owned or operated by the United States.⁷⁰

In its mode of operation, too, the IRAC appears to differ little from that of fifty years ago. Any member agency is entitled to bring to IRAC a request for frequency use. Such a request seems to be automatically considered justified provided only that space can be found for it in the spectrum. If there are conflicting demands, or a prior user of the frequencies in question, there will be an attempt to work out a compromise; should agreement prove unreachable, final authority to mandate a solution resides with the Director of the OTP, and, should he be asked to intervene, the

⁶⁴ Note, *The Crisis in Electromagnetic Frequency Spectrum Allocation*, *supra* note 31.

⁶⁵ See, e.g., *American Bond & Mortgage v. United States*, 52 F.2d 318 (7th Cir. 1931), and text quoted, note 50 *supra*.

⁶⁶ Note, *The Crisis in Electromagnetic Frequency Spectrum Allocation*, *supra* note 31.

⁶⁷ *Id.*

⁶⁸ *Id.*

⁶⁹ Exec. Order No. 11,556 § 10, 3 C.F.R. 283 (1974) (as amended by Exec. Order No. 11,921, 41 Fed. Reg. 24,294 (1976)).

⁷⁰ *Id.* § 3; Reorganization Plan No. 1 of 1970 § 1, 35 Fed. Reg. 6421 (1970), reprinted in 84 Stat. 2083 (1970).

President.⁷¹ There appears to be only incidental consideration of public interest, convenience, or necessity in this process, and the law does not require more. The assignment of frequencies to government radio stations is wholly at the discretion of the President,⁷² and this seems usually to reflect the convenience of a limited number of agencies, the prime concerns of which are often quite different from the broad public interest which Congress intended the FCC should represent. Since no law limits the frequency bandwidth which OTP may allocate to government use, disastrous interference between government and private or commercial users has been avoided only by good-will coordination between the two agencies. While this article purports to raise no question concerning the good faith of those involved, nevertheless, we question to what degree this situation allows the FCC to adhere in its decisions to the congressionally mandated standards.

Furthermore, although decisions of the FCC are subject to judicial review, the OTP and the IRAC appear to be immune. Under the judicial review sections of the Administrative Procedure Act,⁷³ a court may hold unlawful and set aside an FCC decision which it finds to be arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law, or not supported by substantial evidence.⁷⁴ Recent court decisions have emphasized that although a court may not substitute its judgment for that of an agency nor find facts de novo except where expressly permitted by law, a decision will nevertheless be found to be arbitrary, capricious, or an abuse of discretion where the agency has not based it on a consideration of all relevant factors, or has made a clear

⁷¹ Exec. Order No. 11,556, § 3, 3 C.F.R. 283 (1974) (*as amended by* Exec. Order No. 11,921), 41 Fed. Reg. 24,294 (1976)); Reorganization Plan No. 1 of 1970 § 1, 35 Fed. Reg. 6421 (1970), *reprinted in* 84 Stat. 2083 (1970).

⁷² 47 U.S.C. § 305(a) says that "Government stations shall use such frequencies as shall be assigned to each or to each class by the President." This is qualified by nothing at all that can be construed as a standard or guideline; the words "public interest, convenience, or necessity" do not appear in § 305(a). Neither do Exec. Order No. 11,556 § 3, and Reorganization Plan No. 1 of 1970 § 1 contain any words that might be construed as guidelines for or limitations on the power of the Director of OTP to assign frequencies to Government radio stations.

⁷³ 5 U.S.C. §§ 701-706 (1970), *as amended by* Act of Oct. 31, 1976, Pub. L. No. 94-574, 90 Stat. 2721.

⁷⁴ *Id.* § 706.

error of judgment.⁷⁵ Courts appear, however, to have no basis for reviewing decisions of the OTP and the IRAC. The Administrative Procedure Act removes from the jurisdiction of federal courts challenges of decisions which constitute "agency action committed to agency discretion."⁷⁶ Although this exemption has been interpreted to be a narrow one, not lightly to be presumed in the absence of a demonstration that such was the clear intent of Congress,⁷⁷ OTP decisions appear to fall within its scope. The test is whether "there is a law to apply"⁷⁸ to the agency action in question; only if the agency has a right to make such a decision, unqualified by statutory standards or legislative intent,⁷⁹ are federal courts deprived of jurisdiction. The existence of statutory standards or legislative intent are to be determined from the context and purpose of the entire statute.⁸⁰ Applying these criteria, it is difficult to argue that the President's power to assign frequencies to government radio stations is other than agency action committed to agency discretion, and therefore not subject to judicial review. This power is not at all qualified by the wording of section 305(a)⁸¹ and is not discussed elsewhere in the Communications Act. It might be argued that Congress nevertheless intended the standard of public interest, convenience, or necessity to apply to government frequency use since it pervades the Act, and courts have found that the entire field of spectrum use is impressed with it.⁸² This argument, however, is difficult to maintain in the face of section 323.⁸³ That section appears to mandate the conclusion that Congress did intend to give the President unfettered discretion to assign frequencies for government use, since it makes provision for

⁷⁵ *E.g.*, *Citizens to Preserve Overton Park, Inc. v. Volpe*, 401 U.S. 402 (1971); *Sabin v. Butz*, 515 F.2d 1061 (10th Cir. 1975); *Nadar v. Sawhill*, 514 F.2d 1064 (Temp. Emer. Ct. App. 1975).

⁷⁶ 5 U.S.C. § 701 (1970).

⁷⁷ *Citizens Comm. for the Hudson Valley v. Volpe*, 425 F.2d 97 (2d Cir.), *cert. denied*, 400 U.S. 949 (1970).

⁷⁸ *Citizens to Preserve Overton Park, Inc. v. Volpe*, 401 U.S. 402, 413 (1971).

⁷⁹ *Strickland v. Morton*, 519 F.2d 467 (9th Cir. 1975).

⁸⁰ *Ness Inv. Corp. v. United States Dep't of Agriculture, Forest Serv.*, 512 F.2d 706 (9th Cir. 1975).

⁸¹ 47 U.S.C. § 305(a) (1970), *quoted in note 72 supra*.

⁸² *KFKB Broadcasting Ass'n v. Federal Radio Comm'n*, 47 F.2d 670 (D.C. Cir. 1931).

⁸³ 47 U.S.C. § 323 (1970).

time sharing between government and commercial or private stations which have independently been assigned the same frequency. Given the state of radio technology in 1934, inclusion of such a provision made unlimited presidential discretion to assign government frequencies entirely reasonable.⁸⁴ Indeed, there is judicial authority that presidential decisions with respect to frequency allocations and assignments for government stations are not reviewable.⁸⁵

The conflict of authority between the FCC and the OTP is the result of the perpetuation of an anachronism due to legislative inertia. That government radio stations should be exempt from regulation by that authority placed over private and commercial stations was established by the Radio Act of 1927, and the Communications Act⁸⁶ continued this policy. The exemption was intended to be a limited one, however, and it was not granted haphazardly or without due consideration of the consequences. The Communications Act, read as a whole, defines a time-sharing spectrum management scheme which was certainly viable at the time it was enacted. Unfortunately, it was adapted to the radio technology of that era, but not to that of ours.

Specifically, the Communications Act exempts government stations from only sections 301 and 303.⁸⁷ The first of these contains the requirement that radio stations operate only after receipt of a federal license, while section 303 describes the powers and duties of the FCC, including its powers to classify radio stations, allocate frequency bands to services, and assign frequencies to individual stations, as well as the requirement that such action be as required by the public interest, convenience, or necessity. Moreover, section 305(a) provides explicit and unqualified authority for the President to exercise these powers of classification, allocation, and assignment with respect to government radio stations. Had Congress desired, government stations could have been exempt from more provisions

⁸⁴ In some special cases, including possibly the passive services, legislative acts not directly related to telecommunications may set standards which can be taken as a basis for providing jurisdiction for court review. But this is at most a limited exception. See Section V *infra*.

⁸⁵ *Bendix Aviation v. FCC*, 272 F.2d 533 (D.C. Cir. 1959), *cert. denied*, 361 U.S. 965 (1960). See discussion of this case, this Section *infra*.

⁸⁶ 47 U.S.C. § 305(a) (1970).

⁸⁷ 47 U.S.C. §§ 301, 303, 305(a) (1970 & Supp. V 1975).

of the Act than sections 301 and 303; indeed they could have been exempted from the entire Act.⁸⁸ Furthermore, there is explicit language, both in section 305 and in other provisions of the Act, which constrains the operation of government stations. Thus section 305(a) itself requires that they shall obey FCC rules "designed to prevent interference with other radio stations and the rights of others," when not transmitting communications or signals relating to government business. The minimum power requirement of section 324⁸⁹ applies to "all radio stations, including those owned and operated by the United States." It would appear, then, that the proper construction of the Act is that at least some standards for the operation of government stations have been established thereby, though they need not be licensed by the FCC and receive, instead, their frequency allocation and assignments from the President.

This is no small exception. It gives the President, and hence his delegate, the OTP,⁹⁰ equal power with the FCC to allocate the entire frequency spectrum. Both agencies appear able, in theory, to assign the same frequency to different stations, which may then interfere with each other. Today it may seem incredible that the Congress, legislating to remedy the chaotic interference situation that had developed in the 1920's, could have devised a system with so patent a conflict of authorities that it seems to fail to establish any mechanism for preventing use of the same frequency by both the government and private or commercial interests. Yet there is no provision in the Communications Act which limits in any way the power of either agency to allocate any frequency.

The key to the situation is section 323,⁹¹ to which we have already referred. It provides that where a private or commercial station and a government station at the same frequency operate in such close geographical proximity that interference cannot be avoided, the government station shall transmit only during the first fifteen minutes of each hour, local standard time, while the

⁸⁸ For example, in contrast to § 305(a), § 328 exempts stations in the Canal Zone from §§ 301 to 362.

⁸⁹ 47 U.S.C. § 324 (1970).

⁹⁰ It also applies to any successor delegate that the Carter administration may designate.

⁹¹ 47 U.S.C. § 323 (1970).

private or commercial station shall not use its transmitter during that period of time. This provision was entirely reasonable in 1934 when it was enacted into law, and puts the conflict of authorities between the FCC and the President in its proper perspective. Congress did indeed foresee that both the FCC and the President might assign the same frequency to different radio stations, and that these stations might then be capable of interfering with each other. Congress, however, did not intend that such interference occur. It designated and wrote into law a simple time-sharing requirement. The government station would operate during, and only during, specific periods of time totaling twenty-five percent of the day, and the private or commercial station would operate only during the remaining seventy-five percent of the day; both would then be interference-free. Unfortunately, a rapidly advancing technology made this plan obsolete and unworkable not many years after section 323 was enacted, but the national legislature has not to this day seen fit to modernize the law.

In 1934, radio spectrum use was dominated by standard broadcasting. Few things could be more reasonable, should frequencies prove to be in short supply, than that one radio broadcast station should go off the air for a short period of time to allow another to operate at the same frequency.⁹² From the World War II era to the present, however, there have developed a multitude of uses for the spectrum which do not resemble broadcasting in the least degree, and for which time-sharing is quite impossible. A modern airport cannot shut down operations during a portion of every hour while its radars go off the air, nor can the military shut off its missile-detection radars periodically for forty-five minutes.⁹³ Business operations transmitting data from one computer to another over radio links cannot operate economically if they must shut down every hour on the hour. Finally, the passive services cannot turn off their receivers at specified times, because the time when nature transmits its radio signals cannot be mandated in advance by mere human law. Given this situation, the FCC and the

⁹² But under § 323, government stations are not required to go off the air "in case of signals or radio communications relating to vessels in distress and vessel requests for information as to course, location, or compass direction."

⁹³ The entire flight time of an ICBM from launch to impact is but thirty minutes.

OTP and its predecessors have followed the only course open to them. They collaborated to ensure that they simply do not assign two users to the same frequency under circumstances where interference between them is possible.⁸⁴ This practice, however, has had the effect of defeating one of the main purposes of both the Communications and Communications Satellite Acts.

Nothing could be clearer from these statutes than that Congress intended private and commercial use of the radio spectrum to be governed by considerations of public interest, convenience, or necessity. These words appear over and over again in many provisions of both acts. By providing a mechanism for judicial review, Congress guaranteed that the FCC must give effect to them, and the courts have repeatedly held that they define a standard to which FCC decisions must demonstrably conform.⁸⁵ However, it is by no means clear that the same standard was meant to apply to the operation of government radio stations. It appears to have been assumed that no great harm would result if the government, which, after all, had begun to regulate its own spectrum use through the IRAC, should take what frequencies it would. In the happenstance that the FCC, operating independently, should assign the same frequency to a private or commercial station, they would merely time-share. An FCC operating independently and according to public interest, convenience, or necessity is impossible, however, when it must arrive at its frequency-allocation scheme through compromise with another agency not bound by that standard, though having spectrum-management powers equal to its own. There is little evidence that the IRAC bases its frequency allocations on a consideration of public interest, convenience, or necessity; however, there is evidence that the FCC reallocates frequency bands to bar private and commercial use, or to allow only uses compatible with the government use, when such are allocated to

⁸⁴ OFFICE OF TELECOMMUNICATIONS POLICY, *THE RADIO FREQUENCY SPECTRUM—UNITED STATES USE AND MANAGEMENT*, at D-1 (Aug. 1975). See also *Biomedical Radio Telemetry*, 43 F.C.C.2d 363, 364 (1973); *Class E Citizens Radio Service*, 41 F.C.C.2d 147, 148 (1973); *Telemetry in the Band 1427-35 MHz*, 41 F.C.C.2d 990 (1973).

⁸⁵ See, e.g., *FCC v. RCA Communications*, 346 U.S. 86 (1953); *NBC v. United States*, 319 U.S. 190 (1942); *WOKO, Inc. v. FCC*, 153 F.2d 623 (D.C. Cir. 1945), *rev'd on other grounds*, 329 U.S. 223 (1946); *Heitmeyer v. FCC*, 995 F.2d 91 (D.C. Cir. 1938).

a government service by the IRAC.⁹⁶ This has happened even where the commercial user has substantial economic clout.⁹⁷ IRAC deliberations are generally closed, and its decisions do not appear to be supported by written findings and conclusions on the basis of which a reviewing body could assure itself that all elements of the public interest were considered in reaching the decision in question. Of course, it probably should be presumed that government operations funded by Congress are in the public interest; however, should every spectrum use which benefits the public interest be given all the bandwidth it might practically use, it would quickly be discovered that the available frequencies are insufficiently numerous to prevent a chaotic interference situation. Many private or commercial enterprises of demonstrated value to the public interest have been denied licenses for lack of spectrum-space to accommodate them.⁹⁸ It is essential, therefore, to weigh the public interest value of each conflicting spectrum use, as well as its necessity and convenience.

That the IRAC and the OTP need not base decisions upon public interest considerations makes it impossible for the FCC to make frequency allocation decisions in the public interest, in spite of the fact that FCC decisions are subject to judicial review.⁹⁹ The problem is not merely that the OTP and the IRAC can appropriate to a relatively unimportant government use a frequency band which might otherwise be available to a private or commercial use of greater public value. The greatest potential harm arises from the fact that bands which are allocated to a given service by the OTP or the IRAC to facilitate a specific government spectrum use may often be most efficiently shared with particular private and commercial interest, including those whose use is the same or

⁹⁶ See, e.g., *Bendix Aviation Corp. v. FCC*, 272 F.2d 533 (D.C. Cir. 1959), *cert. denied*, 361 U.S. 965 (1960); *Class E. Citizens Radio Service*, 41 F.C.C.2d 147, 148, 152-54 (1973).

⁹⁷ *Bendix Aviation Corp. v. FCC*, 272 F.2d 533 (D.C. Cir. 1959), *cert. denied*, 361 U.S. 965 (1960).

⁹⁸ *Id.*; *American Bond & Mortgage v. United States*, 52 F.2d 318 (7th Cir. 1931).

⁹⁹ The problem may not exist for frequency assignment decisions since, once a band has been allocated to use by services of a strictly commercial or private nature, the FCC need interact no further with the OTP in making assignments in these bands. However, some bands are allocated to services which include both government and private or commercial users, and in considering frequency assignments therein, the FCC and the OTP must collaborate.

similar in character. It must be recognized that the IRAC is composed of agencies which may in fact represent private or commercial interests, or which may merely be required to promote the welfare of these interests in the proper exercise of their authority. Therefore, the FCC could be forced to choose between maximizing efficiency of spectrum use and considerations of public interest which would otherwise mandate allocating a band to services which cannot share with the government service in question. If, after the OTP or the IRAC has allocated a band to a particular service for government use, the FCC allocates the same band to the same service for private use, or to one of a limited number of services which can share the band without interfering with the government stations, how can the public be assured that all elements of the public interest, convenience, and necessity have been considered?

We emphasize that the fact that the OTP allocation might be to a service, the operation of which is undoubtedly in the public interest, is not the important consideration. What bands and how much bandwidth are to be allocated for use by private or commercial interests, or for their benefit, was intended by Congress to be decided solely by the FCC as part of a comprehensive frequency management scheme that considered all elements of the public interest as well as the public convenience and necessity. Furthermore, this scheme was to be publicly justified and subject to judicial review. Under the system which now exists, there is a lack of public evidence that all elements of public interest, convenience, and necessity have been considered in the development of the frequency allocation plan that the OTP and the FCC have worked out between them. Not only is this plan not effectively subject to judicial review, but there is reason to fear that the interests of some special groups could be unduly favored at the expense of others.

The obvious conclusion is that the FCC cannot assign frequencies to private and commercial spectrum users according to the public interest, convenience, or necessity once it is conceded that it cannot operate independently of the OTP, but must divide the available spectrum with that agency according to no standard other than whatever compromise the member agencies of the IRAC have found it convenient to make. That some weighing of public interest considerations may in fact take place and that the FCC

and the OTP appear to have devised a frequency allocation scheme that does, to at least some degree, appear to serve the public interest are no more than tributes to those career civil servants whose conscientious labor has made this so. It says nothing in favor of a law which was supposed to establish a uniform standard for private and commercial spectrum use and provide a means of ensuring that the application of that standard would be as free as possible from arbitrariness, caprice, and undue influence by powerful special interests, but instead has created a system which encourages these to reign unchecked.

It is remarkable that frequency allocations have not been litigated more frequently. Perhaps the principal case in the area is *Bendix Aviation v. FCC*,¹⁰⁰ and it provides emphasis for all that has just been said. At issue there was the FCC response to a decision by the Office of Defense Mobilization (ODM), which at that time exercised the presidential authority to assign frequencies to government radio stations now delegated to the OTP. That decision was to assign frequencies in the bands 420 to 450 MHz and 8.5 to 9.0 GHz to classified government "radio positioning" operations (military radars). At the request of the ODM, the FCC reallocated these bands to bar, ultimately, all private and commercial use of the frequencies therein. Previously, the bands had been available to the aeronautical radio-navigation service. Bendix, which pursuant to the reallocation had been refused a license for experimental use of an airborne aircraft collision avoidance system at 430 MHz, and parties including several airlines which had licenses or were committed to seeking licenses for radars at 8.8 GHz challenged the reallocation in two separate actions, which were consolidated. The decision will be referred to throughout this article, since it considered issues concerning both the International Telecommunications Convention and the necessity for the use of a particular frequency, which will be relevant to our discussion of problems of the passive services. What is important for present purposes is that the court recognized that the President had authority under section 305¹⁰¹ to assign the frequencies in question to government use and that this decision was not subject to ju-

¹⁰⁰ *Bendix Aviation Corp. v. FCC*, 272 F.2d 533 (D.C. Cir. 1959), *cert. denied*, 361 U.S. 965 (1960).

¹⁰¹ 47 U.S.C. § 305(a) (1970).

dicial review. The FCC on the other hand, was held to have made a reasonable and neither arbitrary nor capricious decision with respect to what served the public interest, convenience, or necessity, when, at the request of the ODM and in the name of national security, it acted to remove frequency bands which were to be used by the government from private use. The court proclaimed itself to be well aware of the problem of dual frequency allocation authority and further noted counsel's arguments concerning its potential for compromising the public interest,¹⁰² but concluded that the problem posed was for Congress to resolve. Presumably, had the FCC had no substantial evidence upon which to base its decision that a paramount national security interest justified its reallocation decision,¹⁰³ the court could have reversed that decision. This would have been a Pyrrhic victory for the plaintiff, however, for the crucial decision was that of the ODM to allow military use of these frequencies for "radio positioning," and this decision was exempt from judicial review. The radars in question happen to be among the most powerful transmitters on this planet, and even had they prevailed against the FCC, the plaintiffs would have been confronted with a probably intolerable interference situation about which they could do little.¹⁰⁴

The dual authority problem has existed for too long now. It has been amply discussed in the literature¹⁰⁵ and much verbiage has

¹⁰² 272 F.2d 539-40:

We have fully appreciated the importance of the issue. We do not question that Bendix is competent and qualified. We recognize the depth of the conflict between the demands of the Executive on the one hand and of private but important non-Government entities on the other. Various possibilities of abuse can be conjured were we to speculate, but we cannot assume and there is no slightest suggestion of record, that there has been a perversion of the Commission's administrative processes for an improper purpose.

¹⁰³ The evidence, however, consisted of classified documents which the court refused to scrutinize, even in camera. Must the FCC abandon to the government any frequency for any use, no matter how trivial, where the government chooses to mask the nature of its use behind a security classification?

¹⁰⁴ Had events taken this course, however, they might have sought to require the government to conform with 47 U.S.C. § 323 and shut down its radars for the final 45 minutes of every hour. It is an interesting speculation whether a court decision to this effect would have provoked Congressional action to resolve the dual authority problem.

¹⁰⁵ See, e.g., Note, *The Crisis in Electromagnetic Frequency Spectrum Allocation*, *supra* note 31; Robinson, *Radio Spectrum Regulation: The Administrative Process and the Problems of Institutional Reform*, 53 MINN. L. REV. 1179 (1969).

been devoted to proposing solutions, such as the selling of frequency-channels at auction,¹⁰⁶ which lack merit in varying degrees. We cannot allocate space to discuss these; it is enough to note that they provide no remedy for the favoring of powerful or wealthy special interests at the expense of the public good and could even make such favoritism more likely. Here we advocate an approach which is simple, readily implemented, and capable of curing the problem. We can, in fact, live with the dual authority of the FCC and the OTP if we but eliminate its potential for abuse. Coordination between these agencies is effective; there is no need to attempt to establish new agencies or alternate procedures. The problem with the existing system is not that it does not work, but that it works without standards intended to govern the operations of the FCC. Therefore, it seems to us that all that is required is for Congress (1) to recognize existing practices by incorporating co-ordination between the FCC and the OTP into the Communications Act, and (2) to establish standards to govern it. Once this is done, that process will automatically be subject to judicial review under the terms of the Administrative Procedure Act.

We specifically propose that the FCC and the OTP together be obligated to draw up a single comprehensive frequency allocation plan and to assign frequencies to government and private or commercial stations in a manner which will avoid interference between them. In these endeavors they should be required to conform to the "public interest, convenience, or necessity" standard and to make every possible effort to achieve efficient and economical use of the spectrum. We would allow the President unfettered discretion to assign frequencies to government stations only if these frequencies are in a band solely allocated to government use and the assignment poses no possibility of interference between the government station and a private or commercial station.¹⁰⁷ The availability

¹⁰⁶ Note, *The Crisis in Electromagnetic Frequency Spectrum Allocation*, *supra* note 31, at 472-79, nn.202 & 203; Coase, *The Interdepartment Radio Advisory Committee*, 5 J. LAW & ECON. 17 (1962).

¹⁰⁷ As far as the national defense and security are concerned, surely in this post-Watergate era we can see them in perspective as no more than important elements of the public interest, save in the event of a real emergency. And we should not forget that should a crisis arise, 47 U.S.C. § 606 provides the President with powers to appropriate frequency channels, and these should prove sufficient to cope with it.

of judicial review¹⁰⁸ will guarantee that the formulation of the frequency management plan will consider all elements of the public welfare and will be as free as possible from undue influence by any special interest group.

We believe that all this can be accomplished by repealing section 323 of the Communications Act, which does not recognize the realities of modern technology, and replacing it by the following:

§ 323 Apportionment of the Spectrum between Government and Private or Commercial Stations.

All other provisions of this chapter notwithstanding:

- (a) From time to time, as circumstances require, and subject to public interest, convenience, and necessity, the President or his delegate shall, together with the Commission, devise a comprehensive scheme of frequency management, including the allocation of bands of frequencies to various classes of private, commercial, and government radio stations.
- (b) Where interference between a government station and a private or commercial station is potentially a consideration, public interest, convenience, and necessity shall govern use of the radio spectrum by the government, including the assignment of frequencies to government radio stations.
- (c) In implementing the terms of this section, both the President and the Commission shall make every effort to ensure efficient and economical use of the electromagnetic frequency spectrum.¹⁰⁹

IV. INTERNATIONAL TREATIES

Having discussed, from a purely domestic standpoint, the nature of the relationship between the FCC and the OTP, we must now say something about how frequency management by these agencies is impacted by international spectrum-usage treaties to which the United States is a party. We have noted that, although the FCC and the OTP have authority to regulate United States use of the radio spectrum, it is the State Department which negotiates international telecommunications treaties.¹¹⁰ These treaties contain their

¹⁰⁸ That classified data may have been considered in reaching a decision should be no impediment to effective judicial review thereof.

¹⁰⁹ We have attempted to follow in part the wording of 47 U.S.C. § 303, and 47 U.S.C. § 701(b). Our proposal does not require modification of 47 U.S.C. § 303(c) since that section is prefaced by the words, "[e]xcept as otherwise provided in this chapter."

¹¹⁰ See Section I *supra*.

own standards for spectrum use and include frequency allocation schemes. We shall see that although according to a strictly legal interpretation, the effect of these should be small, as a practical matter, the influence of the treaties is enormous. Moreover, the method by which they are negotiated, combined with the way the courts regard them, provides another mechanism for the promulgation of a spectrum management scheme without a guarantee that all elements of public interest, convenience, and necessity have been considered.

International use of the radio-frequency spectrum is governed primarily by the International Telecommunication Convention¹¹¹ and the Radio Regulations of the International Telecommunication Union.¹¹² Their primary purposes are to facilitate cooperation among the signatory nations in the utilization of the radio spectrum and to foster more efficient use of the telecommunications services.¹¹³ To this end, great emphasis is placed on the obligation of national administrations to bar transmissions which cause harmful interference to the transmissions of other countries. However, the International Telecommunication Union (ITU) is not conceived of as an enforcement body. Rather it seems to have been intended to provide a framework in which sovereign nations may voluntarily cooperate to advance their own self-interest by avoiding interfering with one another's transmissions and receptions, without sacrificing their control over their own use of the radio spectrum.¹¹⁴ The role of the ITU in this framework is primarily one of a mediator and disseminator of information. The ITU can be said to possess enforcement power only to the degree that it can assess non-compliance with the standard established by the Regulations and Convention and notify the international community thereof.¹¹⁵

The Regulations are little more than a compact by the signatory

¹¹¹ International Telecommunication Convention, 18 U.S.T. 575, T.I.A.S. No. 6267 [hereinafter cited as Convention].

¹¹² Radio Regulations, *supra* note 1. In addition to the Radio Regulations and the Convention, the United States is party to a plethora of bilateral and multi-lateral spectrum-usage agreements with a wide variety of countries. *See, e.g.*, 42 Fed. Reg. 27,199, 27,200-206 (1976).

¹¹³ Convention, *supra* note 111, art. 4.

¹¹⁴ *See* Convention, *supra* note 111, arts. 4, 44; *see also*, D. LEIVE, INTERNATIONAL TELECOMMUNICATIONS AND INTERNATIONAL LAW: THE REGULATION OF THE RADIO SPECTRUM (1970) [hereinafter cited as LEIVE].

¹¹⁵ *See generally* LEIVE, *supra* note 111.

nations not to interfere with each other's radio transmissions. To accomplish this goal they include guidelines for radio use and a means for establishing international priority among potentially conflicting national frequency uses. For example, Articles 9 and 9A of the Regulations, among other things, establish that the international status of a given national frequency assignment depends upon: (1) whether it causes harmful interference to other users; (2) its conformity with all the provisions of the Convention and Regulations; and (3) the date of its notification to the International Frequency Registration Board.¹¹⁶ Historically, the third of these was of the first importance,¹¹⁷ and priority in time may still support a claim of priority in right even where some other basis can be found for distinguishing between two conflicting uses. It is probably correct, however, to assert that today the primary claim to priority that can be made for an assignment is its conformity with the various technical guidelines contained in the Regulations.

Although it is beyond the scope of this article to engage in a detailed discussion of the Regulations, we will briefly outline the nature of these guidelines. They can be separated into three categories. The first consists of detailed technical requirements such as standards for power levels, spurious radiation, and antennas for various services,¹¹⁸ as well as administrative provisions¹¹⁹ and operational procedures;¹²⁰ these are the concern of the bulk of the regulations. In the second category are found the procedures by which the various national administrations are to interact with the ITU and its permanent organs, such as the International Frequency Registration Board (IFRB), as well as with one another.¹²¹ About these two categories this article will say little more, however, the third is of some importance to it. This is the Table of Frequency Allocations,¹²² the purpose of which is to divide the useable spectrum into bands assigned to services which have international priority.

¹¹⁶ Radio Regulations, *supra* note 1, arts. 9, 9A.

¹¹⁷ *Id.* at 48-62.

¹¹⁸ See, e.g., Radio Regulations, *supra* note 1, art. 7.

¹¹⁹ See, e.g., *id.* arts. 17-21.

¹²⁰ See, e.g., *id.* arts. 22-40.

¹²¹ See, e.g., *id.* arts. 8, 9, 9A.

¹²² *Id.* art. 5.

The method of the Table is to divide the world into three geographical regions,¹²³ each with its own allocation scheme.¹²⁴ A particular frequency band in a given region may be allocated to one service on a primary basis, to another on a permitted basis, and to a third on a secondary basis.¹²⁵ Permitted and primary services have equal rights, except that in the preparation of frequency plans administrations are supposed to give first choice of frequencies to primary services.¹²⁶ Secondary services are recognized as having priority of use in a frequency band provided only that they do not interfere with stations of the primary or permitted services to which that band is allocated, though the latter's use came later in time. Furthermore, secondary services cannot claim protection from harmful interference by stations of a primary or permitted service.¹²⁷ Finally, individual nations are permitted to except themselves from this scheme by attaching a footnote to the Table under the band in question; the degree of international priority to be accorded to services with footnote authority to transmit is indicated by the footnote in question.¹²⁸

The Table of Frequency Allocations is not intended as an enforceable prohibition of non-conforming uses in the various defined bands. Rather, it is intended to give enhanced legal status to certain radio-spectrum users, while denying it to others. The precise legal status so conferred is subject to the interpretation of any concerned administration,¹²⁹ and it seems that the signatories to the Convention intended no more than to commit themselves to consider their good faith interpretation of legal status in making frequency assignments. This commitment is far from trivial, how-

¹²³ *Id.* art. 5 §§ 125-132.

¹²⁴ It is interesting to note that this method of allocation may not remain viable in the space age. For example, a particular frequency band could be allocated to the fixed service in Region 1 (Europe and the U.S.S.R.), but to a space service in Region 2 (Western Hemisphere). Does this mean that a space station, on say, one of the moons of Jupiter would be entitled to transmit in this band if operated by the United States, but not if operated by the U.S.S.R.? If both countries were operating stations in the Jovian system and wished to talk to each other, would they be obligated each to transmit on one frequency and receive on another?

¹²⁵ Radio Regulations, *supra* note 1, art. 5 § 137.

¹²⁶ *Id.* art. 5 § 138.

¹²⁷ *Id.* art. 5 § 139.

¹²⁸ *Id.* art. 5 §§ 140-148.

¹²⁹ See LEIVE, *supra* note 114, at 128-81 and discussion, this Section *infra*.

ever, for administrations have a powerful self-interest in international cooperation so as to avoid large-scale harmful interference with each other's radio communications. The legal standing conferred on an assignment by the Regulations, therefore, is of no small importance. All relevant facts to its determination are recorded by the IFRB in its Master International Frequency Register.

Section 486 (and, with respect to satellite systems, section 639AA) of the Regulations provide that any frequency assignment is to be notified to the IRFB if:

- (a) the use of the frequency concerned is capable of causing harmful interference to any service of an administration; or
- (b) the frequency is to be used for international radio-communication; or
- (c) it is desired to obtain international recognition of the use of the frequency.¹³⁰

Thus failure to make notification of a frequency use either theoretically capable of causing harmful interference or for the purpose of international radio-communication deprives it of all legal standing (but does not make it illegal), even though it is assigned to the primary service indicated by the Table. On the other hand, the legal status accorded by "international recognition" is not defined, but there seems to be an intent to create some standing, however small, for any use which an administration notifies to the IFRB. The only use clearly intended to be proscribed is one which actually causes harmful interference within some other country with a use with greater right to the frequency in question.¹³¹

It is entirely clear from the wording of Article 3 (sections 113-117) of the Regulations that the sole purpose of the Table is to establish a set of priorities which will enable the resolution of international interference disputes by the efforts of the parties concerned, and not to mandate a scheme which the ITU members are bound to follow in devising their own national frequency allocations. Indeed, to give this point its proper emphasis, it is necessary only to quote in full sections 113 and 115 of the Regulations, and the first paragraph of the preamble to the Convention:

Section 113

The Members and Associate Members of the Union agree that

¹³⁰ Radio Regulations, *supra* note 1, art. 9 § 486.

¹³¹ See *id.* art. 3 §§ 113-15. See discussion, this Section *infra*.

in assigning frequencies to stations *which are capable of causing harmful interference* to the services rendered by the stations of another country, such assignments are to be made in accordance with the Table of Frequency Allocations and other provisions of these Regulations.

Section 115

Administrations of the Members and Associate Members of the Union shall not assign to a station any frequency in derogation of either the Table of Frequency Allocations given in this Chapter or the other provisions of these Regulations, *except on the express condition that harmful interference shall not be caused to services carried on by stations operating in accordance with the provisions of the Convention and of these Regulations.*

Preamble to the Convention

While *fully recognizing the sovereign right of each country to regulate its telecommunications*, the plenipotentiaries of the Contracting Governments, with the object of facilitating relations and co-operation between the peoples by means of efficient telecommunications services, have agreed to conclude the following Convention.¹³²

We conclude that the Table's allocations scheme simply need not be followed where frequency assignments do not result in interference to spectrum use in accordance with it by other countries.¹³³

¹³² Radio Regulations, *supra* note 1, art. 3 §§ 113, 115; Convention, *supra* note 111, Preamble (emphasis added).

¹³³ The lengths to which the Convention and Regulations go to emphasize that they purport to create neither a mandatory allocations scheme nor a mechanism to enforce such a scheme are remarkable. The preamble to the Convention "fully" recognizes "the sovereign right of each country to regulate its telecommunications." Article 50, §§ 165 & 166, of the Convention discusses settlement of disputes, including those concerned with which country has priority to a given frequency channel when mutual interference occurs. No mandatory international adjudicatory procedure is established, but settlement may be "through diplomatic channels or according to procedures established by bilateral or multilateral treaties, . . . or by any other method mutually agreed upon;" however, section 166 provides that disputes may also be subjected to arbitration. Administrations are allowed to negotiate footnote exceptions to the Table of Frequency Allocations and to notify the IFRB and have recorded in the Master Register assignments which are not in conformity with that Table. See note 128 *supra*. They are also entitled to have officially noted, as part of the Final Protocol to the Acts of a World Administrative Radio Conference, statements of policy which may indicate an intent to allocate the spectrum in a manner not consistent with the Table. See, e.g., Statement of India concerning 845-935 MHz band, Final Acts of the WARC for Space Telecommunications, April 1972, 23 U.S.T. 1527, T.I.A.S. No. 7435.

For a large and geographically isolated country like the United States, this could provide broad leeway.¹³⁴

Since, in the United States, the Convention and Regulations are accorded the status of a multilateral treaty ratified by the Senate, they are domestic law. Whether this law confers substantive rights on spectrum users beyond those established by the Communications Act or in derogation of its provisions is questionable. The Treaty has occasionally been pleaded by litigants in spectrum disputes, but with little success. Indeed, in *Bendix Aviation* the court in effect held that as far as the rights of parties and commercial spectrum users are concerned, the Treaty is a nullity unless some issue of international interference is involved.¹³⁵ This attitude appears to be common to other decisions as well. For example, *WREC v. Federal Radio Commission*¹³⁶ involved an appeal from a Federal Radio Commission decision which allowed another station, WMT, to increase its transmitter power from 250 watts to 500 watts. WREC feared that this would result in interference to its own broadcasts and argued, among other things, that the grant of increased power was in violation of broadcasting agreements between the United States and Canada. The court, however, held that this point was "unimportant because of the fact that such a condition if it existed would not affect the rights

¹³⁴ We note that since allocations to the passive services result in no transmissions, there is no possibility of harmful interference therefrom. Therefore, it would not violate the Radio Regulations to allocate any frequency band to a passive service, although such allocation did not have the sanction of the Table. Where an allocation in conformity with the Table is contested by a passive service, the FCC should be expected to be able to make a showing of public interest, convenience, or necessity in support of that allocation other than our international obligations, which would not be at issue.

¹³⁵ The *Bendix* court explained:

We need not stop to explore the full import of Article 22 of the International Telecommunications Convention, Buenos Aires, 1952, the preamble of which fully recognized "the sovereign right of each country to regulate its telecommunication." . . . Bendix can take nothing from the treaty which represents the agreement of our Government. Action, if and when taken pursuant to the Convention in behalf of our Government, must be by the President as Chief Executive, and we fail to see how in any respect his action here is contrary to our international obligations. Our review authority extends only to decisions and orders of the Commission.

Bendix Aviation Corp. v. FCC, 272 F.2d 533, 538 (D.C. Cir. 1959), cert. denied, 361 U.S. 965 (1960).

¹³⁶ 67 F.2d 578 (D.C. Cir. 1933).

or interests of WREC.¹³⁷ Moreover, in *United States v. McIntire*,¹³⁸ a claim by defendant that it needed no license from the FCC to broadcast from an off-shore station, by virtue of the International Telecommunications Convention was rejected. On the other hand, it appears that the Convention, Regulations, and other international agreements can supply the principal justification for FCC rules and actions,¹³⁹ especially those which deny to license-applicants the right to broadcast.¹⁴⁰

It would seem, therefore, a fair conclusion that treaties, as domestic law, compel neither the FCC nor the OTP to act in any particular way with respect to frequency allocation. As domestic law, however, they can be used by these agencies to provide an essentially invulnerable defense for any allocation decision which appears to conform to them. At least where the possibility of interference with radio communication of other countries exists,¹⁴¹ the FCC seems entitled to adopt the allocations scheme set forth in the Table of Frequency Allocations of the ITU Radio Regulations. It seems indisputable that the public interest, which is required by the Communications Act to govern frequency allocations,¹⁴² should first of all be determined by other laws where they are applicable. To the extent that the international telecommunications agreements obligate the United States, it is difficult to argue that the FCC must make any showing of public interest greater than the existence of that obligation to support a frequency allocation or other decision in conformity with those agreements. Courts have not held otherwise.¹⁴³

If our interpretation of the operative effect of the international treaties is correct,¹⁴⁴ it creates a potentially undesirable situation.

¹³⁷ *Id.* at 579.

¹³⁸ 365 F. Supp. 618 (D.N.J. 1973) (motion to dismiss temporary restraining order denied), 370 F. Supp. 1301 (D.N.J. 1974) (permanent injunction granted).

¹³⁹ See *WBEN, Inc. v. United States*, 396 F.2d 601 (2d Cir.), *cert. denied*, 393 U.S. 914 (1968).

¹⁴⁰ *United States v. McIntire*, 365 F. Supp. 618 (D.N.J. 1973).

¹⁴¹ At some level this possibility always exists, provided only that some transmission of a radio signal takes place. See Section II *supra*.

¹⁴² 47 U.S.C. § 303(c) (1970).

¹⁴³ See cases cited at notes 135, 136, 138 and 139 *supra*.

¹⁴⁴ There is little judicial authority on the matter. Spectrum management treaties do not appear to have been frequently argued in litigation, and the concern we now consider apparently has never been raised at all.

Our concern arises because, once again, we see a mechanism by which it appears possible to avoid the public policy, originally established by the Radio Act of 1927, that no overall spectrum management scheme be promulgated without consideration of all elements of public interest, convenience, and necessity, or with favoritism toward any wealthy or powerful special interest group at the expense of the public good.¹⁴⁵ The point never appears to have been raised, either in court or before Congress, that treaty provisions may have been intended primarily for the benefit of individual American spectrum users, or particular classes of American spectrum users, and, therefore, should not be available to justify allocation of frequency bands to these users. This possibility is, in fact, expected to be reality, however, because the United States is the world's largest and most powerful spectrum user, and, historically, it has exerted great influence upon the final form of the Radio Regulations, including the Table of Frequency Allocations.¹⁴⁶ The Table is revised every few years at World Administrative Radio Conferences; both the FCC and the OTP work years in advance to prepare United States positions for these conferences.¹⁴⁷ In developing these positions, the FCC is required to consider the public interest, convenience, or necessity, but the OTP is not.¹⁴⁸ The final position of the United States for such a conference is prepared in formal, documentary form by the Department of State, according to the inputs it receives from these two agencies.¹⁴⁹ The State Department also is not constrained to act in accord with that public interest, convenience, or necessity contemplated by the Communications Act and Communications

¹⁴⁵ Radio Act of 1927, ch. 169 §§ 1, 9, 44 Stat. 1162. See H.R. REP. NO. 1886, 69th Cong., 2d Sess. 1, 16-18 (1927).

¹⁴⁶ See LEIVE, *supra* note 114, at 40-80, 109-14, 224-25; compare also, the proposed changes to the Radio Regulations in DEPARTMENT OF STATE, PROPOSALS OF THE UNITED STATES OF AMERICA FOR THE WORLD ADMINISTRATIVE RADIO CONFERENCE FOR SPACE TELECOMMUNICATIONS, GENEVA 1971 (Dec. 1970) [hereinafter cited as UNITED STATES PROPOSALS FOR THE 1971 SPACE WARC] with the changes actually made in the Regulations at that conference. Radio Regulations, *supra* note 1.

¹⁴⁷ OFFICE OF TELECOMMUNICATIONS POLICY, THE RADIO SPECTRUM—UNITED STATES USE AND MANAGEMENT at B-5, 6, C-9 (Aug. 1975).

¹⁴⁸ *Id.* at B-5. The practice of the FCC is to hold public hearings on proposed treaty modifications.

¹⁴⁹ See, e.g., UNITED STATES PROPOSAL FOR THE 1971 SPACE WARC, *supra* note 146.

Satellite Act.¹⁵⁰ It is entirely possible, therefore, that a recommendation of the OTP or the FCC will eventually become a provision of the Radio Regulations, and that subsequently that provision will be used by the FCC as the sole justification for a specific regulation of private or commercial radio spectrum use.¹⁵¹ In such a situation existing judicial precedents would lead a court to uphold the FCC action, but there would actually have been no consideration by it of public interest, convenience, or necessity.¹⁵²

This is a difficult problem. Congress cannot control the power of the State Department to negotiate provisions of treaties, and it would probably not be desirable to limit the power of the FCC to make regulations based on the provisions of these treaties. The best remedy we can propose is judicial vigilance. We suggest that courts adopt the attitude that the Radio Regulations or Table of Frequency Allocations may be deemed to have been made for the benefit of United States spectrum users, to the degree that they have adopted the United States negotiating position. Where the motivating force behind the adoption of a treaty provision was an American requirement, that provision should be given no weight in a determination by the FCC of public interest, convenience, or necessity with respect to a private or commercial spectrum user.¹⁵³ Where no showing of public interest, convenience, or necessity,

¹⁵⁰ The power of the Executive to negotiate spectrum-management treaties is established by U.S. CONST. art. II, § 2, cl. 2, and any attempt by Congress to mandate standards for such negotiation would be void. Nothing in the Communications Act or in the Communications Satellite Act purports to bind the State Department to negotiate according to public interest, convenience, or necessity.

¹⁵¹ Something very similar to this was in fact what happened in *Bendix Aviation v. FCC*, 272 F.2d 533 (D.C. Cir. 1959), *cert. denied*, 361 U.S. 965 (1960).

¹⁵² There might well be no government interest at stake, and the situation here might arise even in the absence of the conflict of authority between the OTP and the FCC. The FCC might propose a treaty provision to the State Department under circumstances where, if it had instead attempted to enforce the contents of that provision as a purely domestic regulation, a court would strike it down. But it is difficult to imagine a private or commercial interest that would potentially be wronged by the provision even trying to prevent the FCC from making a recommendation to the State Department. Once the recommendation has been accepted by the State Department and incorporated in the treaty, the injured party would be out of luck.

¹⁵³ Especially should this be true where the purported treaty obligation is merely a footnote, *see* note 128 *supra*, whereby the United States has chosen to except itself from the general international regulatory scheme for the benefit of some domestic interest.

other than such a treaty provision, has been made by the FCC, courts should not enforce disputed FCC regulations. Courts should carefully scrutinize frequency allocations and other FCC decisions, purportedly required by our treaty commitments, to ensure that a bona fide international obligation is at issue.

We emphasize our principal conclusions with respect to the effect of international agreements. The case law seems strongly to support the proposition that should the FCC allocate some frequency band in a manner at variance with treaty provisions it would not be possible for a private or commercial party disadvantaged by this decision to persuade a court to reverse it on the basis of the treaty alone. Instead, the challenger would have to allege that the allocation was contrary to public interest, convenience, or necessity, or was otherwise in conflict with non-treaty law. The treaty is a one-way street. It can be used by the FCC to support its decisions; it provides no basis upon which private or commercial interests can mount challenges thereto. Therefore, courts should be alert to the possibility that where a treaty provision is argued in support of an FCC decision that provision was actually agreed to at the instigation of the United States. Where this is true, the court should look behind the treaty provision to the domestic interest concerned, and satisfy itself that full consideration of all elements of public interest, convenience, and necessity would give a result no different from that which follows from application of the treaty.

V. ALLOCATIONS TO THE PASSIVE SERVICES

The major purpose of this article is to discuss frequency allocation with respect to passive scientific research. To do this properly, however, we have found it necessary to discuss in some detail the role played in the frequency allocation process by the FCC, the OTP, and State Department. This is because these agencies have conflicting authority, and this creates possibilities for arbitrary or capricious decisions which can thwart the congressional policy¹⁵⁴ that private and commercial spectrum use be governed by public

¹⁵⁴ This congressional policy is expressed in the Communications Act of 1934, 47 U.S.C. §§ 151-606 (1970 & Supp. V 1975) (originally the Radio Act of 1927, ch. 169, 44 Stat. 1162, and in the Communications Satellite Act of 1962, 47 U.S.C. §§ 701-744 (1970)).

interest, convenience, or necessity. The potential consequences of this are especially serious for the passive services.

We contend that the Communications Act and Communications Satellite Act should be understood to mandate that specific factors in favor of frequency allocations to passive services must be considered. This argument is founded primarily upon our interpretation, supported by judicial precedent and principles of statutory construction, of the meaning of "public interest, convenience, or necessity," the standard imposed by those Acts. To the degree that it is presently possible, as a result of multiple agency authority, to make frequency allocations in derogation of that standard, the rights of the passive services may be denied. Although this is true for other services, it is a matter especially serious for the passive services, because they do not represent profit-making enterprises. Unfortunately, in modern society it seems to require money to defend jeopardized rights, and, unlike the giants of the telecommunications industry, the passive services are poor. Just as their product, knowledge, benefits primarily society, so must they rely on society for the defense of their rights. The conflict of authority among federal agencies with spectrum management powers is a threat to the ability of the passive services to conduct scientific research of great social value. Congress and the courts should take care to see that this threat is ended.

Our interpretation of public interest, convenience, and necessity with respect to the passive services rests upon three pillars: (1) that the special character of scientific research raises an issue of public necessity that has been absent in most disputes over spectrum use; (2) that scientific research is a national concern which extends far beyond mere regulation of telecommunications, and that in determining the public interest, federal science policy cannot be ignored; and (3) with respect to the passive services only, frequency allocation standards which bind the OTP, as well as the FCC, may exist as a consequence of legislation outside the telecommunications area. If we are correct in the latter, these standards may provide a round-about solution for at least part of the multiple-authority problems, but only with respect to the passive services. The direct resolutions that we have proposed are to be preferred.

A. *Judicial Interpretation of Public Interest, Convenience, or Necessity*

As is true of other utilities, entry in the communications field is conditioned on a finding that obtaining the service is in the "public interest, convenience, or necessity." At least in telecommunications litigation, courts typically treat all three terms as though they were one word, with a meaning very close to "public interest" standing by itself.¹⁵⁵ Since the terms are disjunctive, however, we believe that a conflict among the elements should be resolved by the FCC by weighing one against the other.¹⁵⁶ For example, if use of a particular frequency is necessary to one service, but not to another, the former might have priority with respect to it, even though the latter's use were thought to be somewhat more in the public interest. Consideration of factors of public necessity differentiable from public interest is mandatory since failure of the FCC to weigh all relevant factors is per se arbitrary and capricious and therefore grounds for reversal.¹⁵⁷ There appears to be no directly applicable authority relating to frequency allocation, however, since most litigated FCC decisions involve radio and television broadcast station licensing. Licensing disputes generally turn upon issues of public interest only. They seldom are framed in terms of convenience or necessity. We feel that allocations to the passive services involve considerations of both public interest and necessity. Therefore, we discuss both separately.

1. *The Public Interest*

Since, under the Communications Act, the same standard which governs frequency licensing also governs frequency allocations,¹⁵⁸ we turn to the many decisions which concern the former for guid-

¹⁵⁵ Comprehensive research has uncovered only a few instances in which "interest," "necessity," or "convenience" appear to have been understood as possibly conveying separate meanings; these are discussed *infra*.

¹⁵⁶ The Communications Act of 1934, 47 U.S.C. § 309(a) (1970), and the Communications Satellite Act of 1962, 47 U.S.C. §§ 721(c)(7), (9) (1970), mandate a standard of "public interest, convenience, and necessity" (emphasis added) for certain decisions. Where this is the standard, we would argue that all its elements must be present before the activity in question is justifiable. The frequency allocations standard is specifically "public interest, convenience, or necessity" (emphasis added), 47 U.S.C. § 303(c) (1970).

¹⁵⁷ Administrative Procedure Act, 5 U.S.C. § 706 (1970), as interpreted in *Citizens to Preserve Overton Park v. Volpe*, 401 U.S. 402 (1971).

¹⁵⁸ 47 U.S.C. § 303 (1970 & Supp. V 1975).

ance as to what are the elements of public interest. In the first place, what constitutes the public interest in a given situation depends upon the circumstances. The public interest is "to be interpreted by its context, by the nature of radio transmission and reception, by the scope, character, and quality of services."¹⁵⁹ Determination of the public interest is not necessarily a question of fact, however. The FCC has a duty to consider any and all technical factors which may be relevant. It must also interpret the Communications and Communications Satellite Acts and make policy determinations. Factual questions within the special competence of the Commission are only subject to redetermination by reviewing courts when there is no substantive foundation for them in the record.¹⁶⁰ The FCC's determination of the public interest may encompass both matters purely factual and questions of law.¹⁶¹ It is important to understand that this distinction exists—that the public interest may encompass both matters purely factual and questions of law—in order to understand the case law. It appears that courts have seldom been persuaded to correct alleged factual errors in FCC determinations of public interest since fact questions involve the Commission's special competence.¹⁶² Courts, however, have never been reluctant to reverse the FCC because it has incorrectly either applied the law or determined policy.¹⁶³

¹⁵⁹ *Federal Radio Comm'n v. Nelson Bros. Bond & Mortgage Co.*, 289 U.S. 266, 285 (1933). *Accord*, *National Broadcasting Co. v. United States*, 319 U.S. 190, 216 (1943).

¹⁶⁰ *FCC v. Pottsville Broadcasting Co.*, 309 U.S. 134, 145 (1940).

¹⁶¹ *Id.*

¹⁶² "Substantial evidence," however, must support the FCC's findings. *Saginaw Broadcasting Co. v. FCC*, 96 F.2d 554, 559 (D.C. Cir.), *cert. denied*, 305 U.S. 613 (1938); *Western Union Div. v. United States*, 87 F. Supp. 324, 332-33 (D.D.C.), *aff'd*, 338 U.S. 864 (1949).

¹⁶³ *FCC v. RCA Communications, Inc.*, 346 U.S. 86, 94-95 (1953). Many specific questions which come before the FCC partake of both law and fact determination. For example, it has been held that among the elements included in the public interest is the community's need for a service. *National Broadcasting Co. v. United States*, 319 U.S. 190 (1943); *Colonial Broadcasters v. FCC*, 105 F.2d 781, 783 (D.C. Cir. 1939); *see text infra*. This is a binding principle of law; therefore where a community need exists, the FCC must give weight to this need in evaluating an application for a frequency license, or in any other decision that requires consideration of the public interest. But, whether or not a community need exists at all, given the circumstances of a particular case, is a question of fact. In general, whether or not a certain factor constitutes an element of the public interest is a matter of law, but its application to specific circumstances is a question of fact.

The cases define at least three areas of inquiry which, if appropriate to the circumstances, may be relevant to a determination of the public interest. These are: (1) whether there is conformity with the terms and purposes of the Communications Act and, if relevant, the Communications Satellite Act; (2) whether there are telecommunications policy considerations which flow from the use of the word "public" to delineate those interests which are paramount; and 3) whether there are broader considerations of public policy, the scope of which extends far beyond mere telecommunications law.

With respect to the first of these areas of inquiry, the FCC must evaluate the facts before it in accordance with any relevant statutory provisions. It must determine whether harmful interference to other spectrum users is threatened.¹⁶⁴ It should examine the technical competence of a prospective licensee and decide whether such technical characteristics as signal strength and antenna design are sufficient to enable it to provide that service required.¹⁶⁵ The Commission is not limited to making technical calculations. It must satisfy itself that there will be full compliance with communications law and its own regulations.¹⁶⁶ It may, for example, deny a license where the prospective licensee is not a United States citizen, according to sections 303(1)(1) and 303(1)(2) of the Communications Act.¹⁶⁷ Finally, observance of technical formalities mandated by the Act is not in itself enough; the purpose of the Act must also be considered. It is a policy of the Act, for example, to make the radio spectrum a public resource not subject to private ownership rights. Hence, a license must be denied to one whose purpose is to sell it for profit rather than to use it to provide a needed public service.¹⁶⁸

As far as we have gone, the FCC need do little more than read the Communications Act and check for compliance with its terms. When we come to the other two areas of inquiry which are relevant

¹⁶⁴ *National Broadcasting Co. v. FCC*, 362 F.2d 946 (D.C. Cir. 1966); *Colonial Broadcasters v. FCC*, 105 F.2d 781 (D.C. Cir. 1939).

¹⁶⁵ *See FCC v. WOKO, Inc.*, 329 U.S. 223 (1946); *Louisiana Television Broadcasting Corp. v. FCC*, 347 F.2d 808 (D.C. Cir. 1965).

¹⁶⁶ *Colonial Broadcasters v. FCC*, 105 F.2d 781 (D.C. Cir. 1939).

¹⁶⁷ *Id.*

¹⁶⁸ *Crowder v. FCC*, 399 F.2d 569 (D.C. Cir.), *cert. denied*, 393 U.S. 962 (1968); *Follways Broadcasting Co. v. FCC*, 375 F.2d 299 (D.C. Cir. 1967).

to the public interest, however, we tread on less certain grounds. With respect to the first of these, considerations of telecommunications policy which are derived from the term "public interest," but are not mandated by specific provisions of the Communications Act, it has been held that the public interest is the interest of the "listening public in the larger and more effective use of radio."¹⁶⁹ Therefore, the FCC must weigh any benefit to the public against any loss the public suffers,¹⁷⁰ and it must ensure that needed services are provided to the community.¹⁷¹ The public interest, however, has not been interpreted to mean that which brings the greatest good to the greatest number. Wherever possible, minority interests must be protected and considered as part of the public interest, provided only that spectrum space be available.¹⁷² Where even a small fraction of a community has an interest not shared by the rest, that must be accommodated, even though catering to the majority interest might be more profitable.¹⁷³ It has been held that the public interest requires diversity of broadcast format,¹⁷⁴ as well as diversity of approach and viewpoint with respect to editorials, reportorial assignments, and news coverage,¹⁷⁵ that the Commission must consider and attempt to meet the needs of educational television, as well as those of commercial interests;¹⁷⁶ that geographical minorities or other portions of the public may not be deprived of

¹⁶⁹ *National Broadcasting Co. v. United States*, 319 U.S. 190, 216 (1943), citing 47 U.S.C. § 303(g) (1970).

¹⁷⁰ *Democrat Printing Co. v. FCC*, 202 F.2d 298, 301 (D.C. Cir. 1952).

¹⁷¹ *National Broadcasting Co. v. United States*, 319 U.S. 190 (1943); *FCC v. Sanders Bros. Radio Station*, 309 U.S. 470 (1940); *Robinson v. FCC*, 334 F.2d 534 (D.C. Cir.), cert. denied, 379 U.S. 843 (1964); *Democratic Printing Co. v. FCC*, 202 F.2d 298 (D.C. Cir. 1952); *Colonial Broadcasters v. FCC*, 105 F.2d 781 (D.C. Cir. 1939).

¹⁷² *H&B Communication Corp. v. FCC*, 420 F.2d 638 (D.C. Cir. 1969).

¹⁷³ *Citizens Comm. v. FCC*, 436 F.2d 263 (D.C. Cir. 1970) (buyers of radio station were not allowed to abandon classical music format even though surveys established that only 16% of listening public preferred classical music, and that more advertising revenue could be received by converting to a popular music format).

¹⁷⁴ *Lakewood Broadcasting Serv. v. FCC*, 478 F.2d 914 (D.C. Cir. 1973); *Citizens Comm. to Keep Progressive Rock v. FCC*, 478 F.2d 426 (D.C. Cir. 1973).

¹⁷⁵ *Greater Boston Television Corp. v. FCC*, 444 F.2d 841 (D.C. Cir. 1970), cert. denied, 403 U.S. 923 (1971).

¹⁷⁶ *Pennsylvania State Univ. v. FCC*, 304 F.2d 956 (D.C. Cir. 1962).

service;¹⁷⁷ and that diversity of ownership is important to the public interest.¹⁷⁸ Where the interests of two special groups conflict, the FCC must weigh the possible gain of one against the possible loss of the other.¹⁷⁹

The public interest is seen as something distinct from economic interests of spectrum users. A license to use publicly owned resources imposes obligations which could require the licensee to make financial sacrifice.¹⁸⁰ Economic injury to the licensee is in and of itself not an element of the public interest which the FCC must weigh.¹⁸¹ An old line of cases held that, in license renewals, valuable rights and investments made in reliance on a license of the FCC should not be destroyed except for compelling reasons;¹⁸² however, these cases are no longer followed. Where there is competition for a license, no presumption in favor of an applicant for renewal exists. Whether his application will serve the public interest is to be determined without regard for his potential financial loss.¹⁸³ Only where economic injury to a spectrum user spells destruction or diminution of service to the public does it become an element of the public interest.¹⁸⁴

Finally, it is clear that the public interest is identical with public policy in its broadest sense, and that FCC decisions must accord with national policies which go far beyond mere telecommunications law, provided only that such policies do not directly conflict with those of the Communications Act itself.¹⁸⁵ Public policy may

¹⁷⁷ *West Mich. Telecasters v. FCC*, 460 F.2d 883 (D.C. Cir. 1972); *Community Broadcasting v. FCC*, 274 F.2d 753 (D.C. Cir. 1960); *Hall v. FCC*, 237 F.2d 567 (D.C. Cir. 1956).

¹⁷⁸ *Community Broadcasting v. FCC*, 274 F.2d 753 (D.C. Cir. 1960); *Clarksburg Publishing Co. v. FCC*, 225 F.2d 511 (D.C. Cir. 1955).

¹⁷⁹ *H & B Communications Corp. v. FCC*, 420 F.2d 638 (D.C. Cir. 1969).

¹⁸⁰ *Citizens Comm. v. FCC*, 436 F.2d 263 (D.C. Cir. 1970).

¹⁸¹ *FCC v. Sanders Bros. Radio Station*, 309 U.S. 470 (1940).

¹⁸² *Churchill Tabernacle v. FCC*, 160 F.2d 244 (D.C. Cir. 1947); *Evangelical Lutheran Synod v. FCC*, 105 F.2d 793 (D.C. Cir. 1939); *Journal Co. v. Federal Radio Comm'n*, 48 F.2d 461 (D.C. Cir. 1931).

¹⁸³ *Citizens Communication Center v. FCC*, 447 F.2d 1201 (D.C. Cir. 1971); *Greater Boston Television Corp. v. FCC*, 444 F.2d 841 (D.C. Cir. 1970), *cert. denied*, 403 U.S. 923 (1971).

¹⁸⁴ *Carroll Broadcasting v. FCC*, 258 F.2d 440 (D.C. Cir. 1958).

¹⁸⁵ *McClellan Trucking Co. v. United States*, 321 U.S. 67, 79-80 (1944):

To secure the continuous, close and informed supervision which enforcement of legislative mandates frequently requires, Congress has vested expert administrative bodies such as the Interstate Com-

be found in the mandate of the Constitution, established by legislative acts, or supported by judicial doctrines, including traditional principles of equity.¹⁸⁶

2. Necessity

The meaning of necessity in "public interest, convenience, or

merce Commission with broad discretion and has charged them with the duty to execute stated and specific statutory policies. That delegation does not necessarily include either the duty or the authority to execute numerous other laws. . . . [Transportation] legislation constitutes the immediate frame of reference within which the Commission operates; and the policies expressed in it must be the basic determinant of its action.

But in executing these policies the Commission may be faced with overlapping and at times inconsistent policies embodied in other legislation enacted at different times and with different problems in view. When this is true, it cannot without more ignore the latter. The precise adjustments which it must make, however, will vary from instance to instance depending on the extent to which Congress indicates a desire to have these policies leavened or implemented in the enforcement of the various specific provisions of the legislation with which the Commission is primarily and directly concerned.

It has been held that the FCC must consider a licensee's conduct with respect to racial discrimination. *Office of Communication of United Church of Christ v. FCC*, 359 F.2d 994 (D.C. Cir. 1966). It has also been held that an applicant for a frequency license must be law abiding, and that the FCC may refuse to issue a license to one whose broadcasts violate criminal laws. *American Broadcasting Co. v. United States*, 110 F. Supp. 374, 384-85 (S.D.N.Y. 1953), *aff'd*, 347 U.S. 284 (1954). The FCC must consider and implement Congressional policies which favor competition, as well as those which restrict it. *FCC v. RCA Communications, Inc.*, 346 U.S. 86 (1953); *Philco Corp. v. FCC*, 293 F.2d 864 (D.C. Cir. 1961); *Metropolitan Television Co. v. FCC*, 289 F.2d 874 (D.C. Cir. 1961); *Federal Broadcasting System, Inc. v. FCC*, 231 F.2d 246 (D.C. Cir. 1956); *Clarksburg Publishing Co. v. FCC*, 225 F.2d 511 (D.C. Cir. 1955). Finally, it has been held that the public interest standard necessarily invites reference to first amendment principles. *Columbia Broadcasting Co. v. Democratic Nat'l Comm.*, 412 U.S. 94 (1973). The implication is clear that the FCC must not only avoid violating the Constitution; it must actively seek to further its policy goals.

¹⁸⁶ See cases at note 185 *supra* with respect to judicial policies. It has been held that the conduct of the FCC must be governed by traditional principles of equity, and that, therefore, all viewpoints brought to the attention of the Commission must be treated equally. *Noe v. FCC*, 260 F.2d 739, 742 (D.C. Cir. 1958). The interests of one spectrum user cannot be treated differently from those of any other, unless the FCC can show the existence of other public interest factors which are compelling. *American Broadcasting Co.-Paramount Theaters, Inc. v. FCC*, 345 F.2d 954, 960, 961 (D.C. Cir. 1965), *cert. denied*, 383 U.S. 906 (1966); *American Broadcasting Co.-Paramount Theaters, Inc. v. FCC*, 280 F.2d 631, 635 (D.C. Cir. 1960). Conformity with procedural requirement also has been recognized as an element of the public interest. *Spanish Int'l Broadcasting Co. v. FCC*, 385 F.2d 615, 622 (D.C. Cir. 1967).

necessity" has not often been discussed in judicial telecommunications decisions. Apparently the issue has not been raised; certainly there is no authority for the proposition that the meaning of "necessity" is the same as "public interest."¹⁸⁷ Since most of the litigated telecommunications disputes involve the award of frequency licenses to radio and television broadcasters, or other regulation of them, it is not really surprising that the necessity issue has not been central to the controversy. The problem of necessity is likely to arise only where users belonging to entirely different services compete for the same frequency, *i.e.*, as a result of the frequency allocation process. Then, at least one can ask whether the frequency in question is more necessary to one than it is to the other and, if so, how that fact limits the FCC's power to allocate frequencies.¹⁸⁸

It has been long established that the meaning of standards such as "public interest" and "public necessity" depends on the purpose of the legislation that establishes them, the requirements that legislation imposes, and the context of the provision in question.¹⁸⁹ To determine the import of "necessity", therefore, we should first consider the overall policy goals of the Communications Act. Perhaps chief among these are ensuring efficient spectrum use, which means maximizing spectrum use while minimizing interference among different users, and guaranteeing that spectrum use be primarily for the purpose of public service. A requirement of "necessity" is consistent with these goals if it means that a particular service of value to the public will be preferred in the allocation of a given

¹⁸⁷ There is some authority outside the communications area that these terms indeed mean different things. *See, e.g.*, *ICC v. Ry. Labor Executives Ass'n*, 315 U.S. 373, 376-78 (1942); *Pan Am.-Grace Airways, Inc. v. CAB*, 342 F.2d 905, 909 (D.C. Cir.), *cert. denied*, 380 U.S. 934 (1965); *Florida-Tx. Freight, Inc. v. United States*, 373 F. Supp. 479, 486 (S.D. Fla. 1973), *aff'd*, 416 U.S. 976 (1974).

¹⁸⁸ "Convenience," too, perhaps ought to be distinguished from "interest" and "necessity." Public convenience, however, does not appear to us to be relevant as a separate consideration with respect to frequency allocation, although it may arise as an issue elsewhere in the telecommunications area. Licensing and allocations problems in telecommunications are above all governed by the natural scarcity of available frequencies. Issues that could be phrased as conveniences in areas such as transportation, where entry is less limited, probably become issues of necessity here.

¹⁸⁹ *Federal Radio Comm'n v. Nelson Bros. Bond & Mortgage*, 289 U.S. 266 (1933) (interpreting the standard in the Radio Act of 1927); *New York Cent. Sec. Corp. v. United States*, 287 U.S. 12 (1932) (interpreting the standard established by the Transportation Act of 1920).

frequency band where its operation would be less feasible in other frequency bands. For example, at frequencies above 1 MHz, the Earth's ionosphere becomes increasingly less reflective. Ordinary commercial radio broadcasting operates by reflecting signals off the ionosphere to home receivers over the horizon from the transmitter. Obviously it would not contribute to the maximization of spectrum use to allocate frequencies around 1GHz, where the ionosphere is entirely transparent to commercial radio broadcasting, while allocating frequencies below 1 MHz to some service which could operate equally well at 1 GHz. Necessity is thus a question of degree and will be great for a service that can operate only in severely restricted frequency bands. Since the real question is efficiency of spectrum usage, to the extent that an individual spectrum user provides a public service, any necessity peculiar to it can also be said to be a public necessity.¹⁹⁰

A careful survey of the telecommunications case law reveals that necessity has, in fact, been an issue in at least one case involving frequency allocation, *Bendix Aviation Corp v. FCC*.¹⁹¹ There the issue was whether developers and users of an airborne

¹⁹⁰ Although telecommunications do not appear to have come to its attention in this respect, the Supreme Court long ago recognized that when a national interest or policy is at stake, private necessity becomes public necessity. For example, the policy that the nation must have an adequate transportation system was invoked to support its holding that the need of railroads for funds "not only for improvement and expansion of facilities, but for adequate maintenance" is proper grounds for issuance of a certificate of convenience and necessity by the Interstate Commerce Commission, permitting abandonment of an unprofitable line. *Akron, C&Y Ry. v. United States*, 261 U.S. 184, 190 (1923); *accord*, *Transit Comm'n of N.Y. v. United States*, 284 U.S. 360 (1932); *Colorado v. United States*, 271 U.S. 153 (1926); *Indian Valley Ry. v. United States*, 52 F.2d 485 (N.D. Ca. 1931), *aff'd*, 292 U.S. 608 (1934).

In *ICC v. Railway Labor Executives Ass'n*, 315 U.S. 373, 376-78 (1942), the Court held:

The phrase "public convenience and necessity" no less than the phrase "public interest" must be given a scope consistent with the broad purpose of the Transportation Act of 1920: to provide the public with an efficient and nationally integrated railroad system. . . . [There is a] national interest in [both the] financial stability [of railroads and] in the stability of the labor supply available to the railroads

. . . There is nothing in the Act to prevent the Commission from taking action in furtherance of the "public convenience and necessity" merely because the total impact of that action will include benefits to private persons, either carriers or employees.

¹⁹¹ *Bendix Aviation Corp. v. FCC*, 272 F.2d 533 (D.C. Cir. 1959), *cert. denied*, 361 U.S. 965 (1960).

aircraft collision avoidance system and air navigation devices should have priority, with respect to the 420-450 MHz and 8.5-9.0 GHz bands, over government radio-location operations (military radars). The court accepted the FCC's conclusion that these bands were the only ones in which the government operations were feasible, while other bands, particularly around 13 GHz, could feasibly be used by the air navigation services. This conclusion was a major factor influencing the court's decision in favor of the government.

B. The Public Interest and Necessity Applied to the Passive Services

We must now consider the need of the passive services for allocated frequency bands, both with respect to the width of these bands and their location in the frequency spectrum. We believe that public interest and necessity require that, with respect to certain frequency allocations, the passive services are to be preferred over other services at least when the active services can be accommodated at other frequencies. The frequency band requirement for the passive services is a matter of necessity, mandated by laws of physics over which man has no control. These strictly limit the freedom of the passive services to operate anywhere in the spectrum. Furthermore, this necessity is not like the private necessity of a broadcaster wishing to be the one to serve a given region.¹⁹² It is like the public necessity of governmental use, since when a passive service is granted an allocation, use of the band is available to the entire population. Public interest considerations include the existence of a public policy in favor of the conduct of scientific investigations for the public benefit which finds expression in judicial decisions and in numerous enactments of the Congress.

That the passive services must be treated at least on an equal basis with all other services follows from the fact that they represent an interest of part of the community. When spectrum space is allocated, this interest cannot be neglected any more than the interests of lovers of classical music,¹⁹³ CATV subscribers,¹⁹⁴ or

¹⁹² Such private necessity would be public necessity, however, where a national interest or public policy is at stake; see note 190 *supra*. We argue, *infra*, that a national interest is indeed at stake when allocations to the passive services are sought. This is the national interest in promoting scientific research.

¹⁹³ See *Citizens Comm. v. FCC*, 436 F.2d 263 (D.C. Cir. 1970).

¹⁹⁴ See *H&B Communications Corp. v. FCC*, 420 F.2d 638 (D.C. Cir. 1969).

educational television broadcasters and users.¹⁹⁵ Absent compelling public interest reasons,¹⁹⁶ the passive services may not be treated inequitably or made to suffer by virtue of a bias toward any other telecommunications service.¹⁹⁷ This is just a beginning. The combination of other elements of the public interest and necessity in passive use of the radio spectrum to gain scientific knowledge for the benefit of all is unique to the passive services and creates a rationale sufficiently compelling to justify some preference with respect to frequency allocations for these services.

The requirement of necessity is especially important with respect to the passive services. Many, though not all, kinds of scientific observation can be performed only at very specific frequencies because of the operation of basic laws of nature. For example, one of the primary goals of radio astronomy is the study of strong atomic and molecular spectral line-radiations, which are always emitted at the same frequency.¹⁹⁸ The most important lines number about two dozen, and their study is crucial to our eventual determination of the structure and evolution of our galaxy, the nature of quasars and exploding galaxies, and a host of other matters.¹⁹⁹ It is simply not possible to make the desired scientific studies at frequencies other than these line-frequencies. This is as extreme an example of necessity as might be imagined; either allocations of particular and narrow frequency bands must be made to the passive services, or a large class of important scientific studies will be impossible. Whatever allocations may be made to the passive services for other reasons, no band can serve as a substitute for a band which contains an atomic or molecular spectral line.

¹⁹⁵ See *Pennsylvania State Univ. v. FCC*, 304 F.2d 956 (D.C. Cir. 1962).

¹⁹⁶ *American Broadcasting-Paramount Theaters, Inc. v. FCC*, 345 F.2d 954 (D.C. Cir. 1965), *cert. denied*, 383 U.S. 906 (1966).

¹⁹⁷ *Id.* See *Noe v. FCC*, 260 F.2d 739 (D.C. Cir. 1958), *cert. denied*, 359 U.S. 924 (1959).

¹⁹⁸ The frequency of a spectral line is determined by the energy-level structure of the atom or molecule in question. Only an atom or molecule at rest with respect to an observer will emit radiation precisely at this frequency, however, particles moving with respect to an observer will emit at frequencies shifted from the basic frequency by the fraction $\pm v/c$ of that frequency where $\pm v$ is the velocity of the particle toward or away from the observer and c is the speed of light. For typical radio lines this fraction is less than 1%.

¹⁹⁹ NATIONAL ACADEMY OF SCIENCES COMMITTEE ON RADIO FREQUENCIES, VIEWS CONCERNING FREQUENCY ALLOCATIONS FOR THE RADIO ASTRONOMY SERVICE IN PREPARATION FOR THE WORLD ADMINISTRATIVE RADIO CONFERENCE—1979

The situation is similar with respect to the Search For Extraterrestrial Intelligence (SETI). Although it is possible that a radio signal from an extraterrestrial civilization could be broadcast at any frequency, the ability to detect such a signal is frequency-dependent. The greater the distance from which a signal of given strength comes, the harder it is to detect it; however, there exists a frequency band in which it is possible to maximize the distance over which a signal can travel and still be detected. This band, 1.400 to 1.727 GHz, lies essentially at those frequencies where naturally emitted background noise is least. At other frequencies the feasibility of detecting an artificial signal of extraterrestrial origin would be diminished; thus necessity should mandate that a passive service devoted to SETI have preference with respect to an allocation of the 1.400 to 1.727 GHz band, at least over users for whom the band is less critical.

As we have indicated, the necessity of the passive services is a public necessity. We have shown that service to the public is the essence of the public interest and that the need of the listening public may not be ignored in the granting of a frequency license.²⁰⁰ It is of the highest importance, therefore, to realize that the passive services exist for no motive of financial profit for business enterprise, but to further the enrichment of public knowledge and scientific progress through scholarly research. This dedication to

(1st revision, Nov. 1975). Some of the most important lines and the $\pm 1\%$ frequency band about them are given in the following table (however, the frequency of the hydrogen line may be subject to larger velocity-shifts than the others).

LINE	FREQUENCY BAND		
Deuterium (D)	322.	- 332.	MHz
Neutral Hydrogen (H)	1.350 -	1.435	GHz
Hydroxyl (OH)	1.596 -	1.628	GHz (4 lines)
CH Molecule	3.230 -	3.296	GHz
	3.302 -	3.382	GHz (2 lines)
Formaldehyde (H ₂ CO)	4.782 -	4.878	GHz
	14.34 -	14.63	GHz
Water (H ₂ O)	22.01 -	22.46	GHz
Ammonia (NH ₃)	23.45 -	24.38	GHz (4 lines)
	24.81 -	25.31	GHz
Carbon Monoxide (CO)	109.10 -	111.306	GHz
	114.12 -	116.42	GHz

There are many somewhat less important molecular lines, especially at frequencies above 30 GHz.

²⁰⁰ See cases cited notes 170 & 171 *supra*.

the public is total. Research results in the areas of radio astronomy, space research, and SETI are published in the open scientific literature without protection of patent or copyright; they may be read and used by all.

The passive services, *inter se*, pose no license assignment problems. The passive services transmit no signals and can therefore cause no interference. Unlike other frequencies, which can only be preserved for the use of a limited number of broadcasters, allocation to passive services allows reception by all who care to do so. Normally, rationing of available licenses is a significant portion of the FCC's responsibility. Indeed, the need for rationing exists in all utilities, and the regulatory agency is the rationer. With respect to passive users, there is no such need excepting, of course, to limit potential active users to other frequencies. Because bands allocated to the passive services are accessible to all, they have a uniquely public character.

We believe that the public interest requirement is determined by the existence of a policy in favor of promoting scientific research. The public commitment to scientific research is impressive. Billions of dollars in public funds have paid not only for sophisticated scientific instruments, but also for the training and support of thousands of highly capable people over the past 20 years.²⁰¹ This massive expenditure by both the state and federal governments is but a part of the public policy of furthering human knowledge and scientific progress, a policy that has its roots in the Constitution²⁰² itself.

²⁰¹ Federal agencies which have contributed impressively to scientific research include the National Science Foundation, the National Aeronautics and Space Administration and the Atomic Energy Commission (superseded by the Energy Research and Development Agency). The Viking mission to Mars, alone, cost approximately one billion dollars.

²⁰² U.S. CONST. art. I, § 8, cl. 8. This section enumerates the powers of Congress, and the clause to which we refer authorizes it to "promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries." What is significant here is that this clause, which forms the basis for our patent system, is not couched as a protection of individual rights, but as a method of promoting a public purpose. The framers of the Constitution could have protected an inventor's rights in his discovery on the theory that as discoverer, he should be entitled to a property right therein; no doubt this is exactly how many inventors regard their patents. But there is no purpose here to protect a property right or any other personal right. The policy sought to be established is the promotion of scientific progress, and the award of the patent power to Congress was made

The scope of the national commitment to provide financial support for scientific research is also evidenced by the large number of congressionally created agencies which supply funds for research scientists as federal civil servants.²⁰³ In addition, virtually every

for this purpose alone. No less, even than freedom of expression and the protection of the rights of accused persons, the advancement of scientific progress is explicitly mandated as a policy goal by the Constitution.

Judicial support for this position may be found. It has been held that the primary purpose of our patent system is not to reward the individual, but to advance the sciences and arts. *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 330-31 (1945). The objective of the clause has been said to be "to promote the progress of science and the arts." *Goldstein v. California*, 412 U.S. 552, 555, *cert. denied*, 414 U.S. 883 (1973). State trade secret laws have been upheld explicitly because they were found to advance this constitutional policy of stimulating progress in science and the useful arts. *Kewanee Oil Co. v. Bicron Corp.*, 416 U.S. 470 (1974).

²⁰³ The largest and most important of these outside the fields of health, medicine, and social science include the National Academy of Sciences (NAS), National Science Foundation (NSF), the Smithsonian Institute and National Zoological Park, the National Aeronautics and Space Administration (NASA), the National Oceanic and Atmospheric Administration (NOAA), the Energy Research and Development Administration (ERDA), and the United States Geological Survey. Agencies such as the Fish and Wildlife Service, the National Park Service, and the Naval Observatory, which support relatively modest research programs are numerous.

Of these agencies, two are concerned with every area of science known to man. These are the National Academy of Sciences and the National Science Foundation. NAS is not really a funding agency, but is charged with defining and investigating scientific policies. 36 U.S.C. §§ 251-54 (1970). NSF, on the other hand, was intended to be the government's main instrument for developing United States leadership in all scientific disciplines. 42 U.S.C. §§ 1861-82 (1970 & Supp. III 1973), *as amended by*, Act of April 21, 1976, Pub. L. No. 94-273, 90 Stat. 378; Act of May 11, 1976, Pub. L. No. 94-282, 90 Stat. 473; Act of Oct. 11, 1976, Pub. L. No. 94-471, 90 Stat. 2057. This agency has a sweeping mandate to initiate and support basic scientific research programs, to strengthen the national scientific research potential, and to encourage and recommend the pursuit of national policies for the promotion of basic research. *Id.* § 1862. Its budget in fiscal 1977 was about \$700,000,000. THE BUDGET OF THE UNITED STATES GOVERNMENT FISCAL YEAR 1977, No. 4-76a, Government Contracts Service, at B-15 (March 15, 1976). Most of this was distributed to scientists in nonprofit institutions to pay salaries, purchase equipment, construct and maintain facilities, and otherwise support all aspects of research. Among the passive services, radio astronomy derives almost its entire support from the Foundation.

Other agencies have been directed to support particular areas of scientific research deemed of special importance. Under the National Aeronautics and Space Act of 1958, 42 U.S.C. §§ 2451-84 (1970 & Supp. V 1975), *as amended by*, Act of April 21, 1976, Pub. L. No. 94-273, 90 Stat. 379-80; Act of June 4, 1976, Pub. L. No. 94-307, 90 Stat. 681; Act of Sept. 17, 1976, Pub. L. No. 94-413, 90 Stat. 1270; Act of Oct. 8, 1976, Pub. L. No. 94-464, 90 Stat. 1988, it is the duty of the National Aeronautics and Space Administration to increase human knowledge of phenomena in the atmosphere and in space, *id.* § 2451(c)(1); to study the utilization of aeronautical and space activities for scientific purposes, *id.* § 2451(c)(4); to preserve the role of the United States as a leader in

executive department has authority to employ scientists to conduct research into natural phenomena, the study of which may further the purposes of the department in question.²⁰⁴ The volume of legislation that specifically protects the research interests of scientists is equally impressive. Indeed, such protection has been one of the main purposes of twentieth century environmental legislation. Many geographical areas have been granted protection because of their unique scientific value.²⁰⁵ In addition, two major

aeronautical and space science and the application thereof, *id.* § 2451(c)(5); to provide monetary support for scientific research which has value to aeronautical and space activities, *id.* § 2458; to conduct or arrange for the conduct of scientific studies by means of the use of aeronautical and space vehicles, *id.* § 2473(c)(2); and to carry out a comprehensive program of research into upper atmospheric phenomena, *id.* §§ 2481-2484. Congress has, over the years, appropriated billions of dollars to fund scientific studies by NASA. Among the passive services, space research is almost entirely supported by NASA, and it is likely also that SETI will derive its primary support from that agency.

The ever-increasing importance of basic scientific research to the national welfare is evidenced by the creation of the Energy Research and Development Administration. Our entire hope for energy self-sufficiency rests upon gaining a sufficient understanding of processes of nature at the molecular, atomic, and elementary particle levels. ERDA has broad authority to support and conduct research which will lead to improved knowledge of the multifarious ways in which nature produces energy, as well as research which will better our understanding of those natural phenomena which promise to improve our ability to use energy more efficiently, 42 U.S.C. §§ 5801, 5813 (Supp. V 1975). This embraces so wide an area that ERDA may ultimately become the most important of the science-support agencies. As yet it does not significantly support any of the passive services; however, radio astronomical investigations of pulsars, quasars, x-ray stars, and other celestial objects are likely to be increasingly relevant to its area of concern.

The National Oceanic and Atmospheric Administration has as its goal the conduct and support of research aimed at understanding the dynamics of the upper and lower atmosphere, the sea, the earth, and the interaction among them. 15 U.S.C. § 1511 (Supp. V 1975). NOAA has supported radio astronomical investigations aimed at understanding solar activity and its influence on climate and weather. The United States Geological Survey is charged with the hiring of scientists to determine the geological structure of the national domain. 43 U.S.C. §§ 31, 34 (1970 & Supp. V 1975). Among its most important present concerns is the understanding and prediction of earthquakes. The radio astronomical technique of very-long-base-line interferometry (VLBI) promises to enable highly accurate determination of earth motions, and future construction of a multi-million dollar national VLBI facility could be a concern of both USGS and NSF. Finally, the Smithsonian Institution and National Zoological Park are charged with the general advancement of scientific knowledge and its diffusion among men, 20 U.S.C. §§ 41, 81 (1970), as well as with specific research tasks in the area of anthropology, paleontology, and biology.

²⁰⁴ See, e.g., 5 U.S.C. § 3104 (1970); 7 U.S.C. § 427 (1970).

²⁰⁵ These include Apostle Islands National Lakeshore, 16 U.S.C. § 460w (1970); Cumberland Island National Seashore, *id.* § 459i (Supp. V 1975); Ice Age National Scientific Reserve, *id.* § 469d; Kings Range National Conservation

pieces of environmental legislation, the 1974 Amendments to the Historic Sites Act of 1935²⁰⁶ and the National Environmental Policy of 1969²⁰⁷ may, by their explicit terms, protect the passive services. If this interpretation is correct, they set standards which bind the OTP as well as the FCC. At the least, they further evidence the public policy of promoting scientific research.

C. Interpretation of Environmental Legislation

We deal first with the National Environmental Policy Act of 1969. The expressed purpose of this Act is to protect "all components of the natural environment" from the "profound impact of man's activity."²⁰⁸ The relevant question for our discussion is whether radio signals produced by natural phenomena or incident upon the Earth from space beyond the domain of man constitute a component of the natural environment. If they do, then interference with these signals is regulated by the terms of the Environmental Policy Act.

The radio signals studied by the passive services seem part of the environment since these signals are physical entities which owe their existence to no human activity. They are no different in this respect from forests, lakes, or wild animal populations. Furthermore, it seems frequently to have been the intent of Congress to include scientific interests as protected objects within the scope of various environmental protection statutes.²⁰⁹ This intent is nowhere better evidenced than by the 1974 Amendments to the Historic Sites Act of 1935,²¹⁰ which we will shortly discuss in some detail. From this the conclusion follows that it would be consistent with congressional policy to treat as a component of the environment electromagnetic radiation generated by mechanisms beyond the control of man and of importance to scientific studies.

This conclusion is different from a claim that the radio spectrum which has often been called a natural resource, is part of the environment. We have pointed out before that although individual

Area, *id.* § 460y; Buffalo National River, *id.* § 460m-8 (Supp. V 1975); and Spruce Knob-Seneca Rocks National Recreation Area, *id.* § 460p-4.

²⁰⁶ 16 U.S.C. §§ 469-469(c) (1970 & Supp. V 1975).

²⁰⁷ 42 U.S.C. §§ 4321-4347 (1970 & Supp. V 1975).

²⁰⁸ *Id.* § 4331(a).

²⁰⁹ See examples cited note 205 *supra*.

²¹⁰ 16 U.S.C. §§ 469-469(c) (1970 & Supp. V 1975).

electromagnetic waves are physical entities, the "radio spectrum" is not;²¹¹ hence our arguments, the concern of which is only the classification of particular, individual electromagnetic waves as environmental components, do not apply to the "radio spectrum." We do not wish to advance any general proposition that "pollution of the airwaves" by excessive transmission requires that every allocation and licensing decision by frequency-management agencies fall within the scope of the Environmental Policy Act. Indeed, radio signals received by active services are generated by human activities, and it is therefore hard to imagine that they are components of the environment. Our argument is limited strictly to interference with specific electromagnetic signals which are of non-human origin and also are important objects of scientific study.

So limited, we believe we are supported by the terms of the Environmental Policy Act. Pursuant thereto, environmental impact statements are required to discuss the "relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity."²¹² This evidences congressional concern with such relationships and implies that it is a purpose of the Act to bring to light those situations where short-term activities affect long-term productivity. Interference with scientific progress is as serious a threat to long-term productivity and the overall betterment of the human condition as can be imagined. Thus to consider electromagnetic waves, which are of interest for scientific study, as an environmental component within the scope of the Environmental Policy Act would be consistent with the purpose of Congress in passing that Act.

If the radiation which the passive services seek to study is a component of the environment, what is the effect of the Environmental Policy Act on the frequency-management agencies? Perhaps the most important effect is to create grounds for judicial review of decisions of the Office of Telecommunications Policy. Under section 305 of the Communications Act, the assignment of frequencies to government radio stations is wholly at the discretion of the President.²¹³ The Communications Act sets no standards whatsoever to govern frequency allocation by the President

²¹¹ See Section III-A *supra*.

²¹² 42 U.S.C. § 4332(C)(iv) (1970).

²¹³ See Section III-B *supra*.

or his delegate, the OTP. Such OTP decisions, therefore, are not subject to judicial review under the Administrative Procedure Act.²¹⁴ Where, however, law defines standards that should govern the making of an agency decision, it no longer can be considered to be action "committed to agency discretion."²¹⁵ The Environmental Policy Act contains standards which are not to be found in the Communications Act. Specifically, all federal agencies are required to consider environmental values in their decision-making,²¹⁶ to study and develop alternative courses of action where there is conflict concerning possible uses of available resources,²¹⁷ and to act in a manner which will avoid unnecessary environmental harm.²¹⁸ On this basis it can be argued that any OTP frequency-allocation decision which has been made without consideration of interference with the passive services, or without a showing that there exists no reasonable alternatives to causing such interference, is subject to review and reversal by a federal court under the Administrative Procedure Act. We repeat our caveat that electromagnetic waves transmitted by other services may not properly be characterized as components of the environment. We believe, therefore, that the power of review of OTP decisions does not reside in the federal courts unless the issue is interference with the passive services.

Whatever the intent of the Environmental Policy Act with respect to scientific interests, there can be no question at all that their protection was the primary purpose of the 1974 Amendments to the Historic Sites Act of 1935.²¹⁹ It is not clear, however, to what extent this legislation affects the telecommunications area. At the very least, the Amendments are an explicit and recent reaffirmation of the congressional policy in favor of the furtherance of scientific research. It can be argued that they also mandate specific statutory standards for the treatment of the passive services by the telecommunications agencies.

The 1974 Amendments replaced and broadened an earlier ex-

²¹⁴ See 5 U.S.C. § 701 (1970).

²¹⁵ See cases at notes 78-80 *supra*.

²¹⁶ 42 U.S.C. § 4332(B) (1970).

²¹⁷ *Id.* § 4332(E) (Supp. V 1975).

²¹⁸ *Id.* § 4331 (1970 & Supp. V 1975).

²¹⁹ 16 U.S.C. §§ 469-469(c) (1970 & Supp. V 1975).

tension of the 1935 Act,²²⁰ which had merely applied to historical or archeological data that might be lost as the result of the construction of Federal or federally licensed dams, reservoirs, or related projects. The main thrust of the new Amendments is to require that the Secretary of the Interior undertake the "recovery, protection, and preservation"²²¹ of "significant scientific, prehistorical, historical, or archeological data"²²² which may be irreparably lost or destroyed by "any Federal or federally assisted or licensed project, activity, or program."²²³ They have strengthened the degree of protection available to the types of data in question, increased the number of different types of data which are eligible for this protection, and broadened the activities against which the protection is available to include essentially all activities of the federal government.

We must here inquire whether the scientific data which is the object of study by the passive telecommunications services is touched by these Amendments. Three specific issues are posed: (1) Do frequency allocation and licensing by federal agencies fall within the category of federal activities to which the Amendments apply?; (2) Are radio signals, generated either by natural processes or artificially, by non-human intelligent extraterrestrial life, scientific data within the meaning of the Amendments?; (3) Do the Amendments govern only in situations where alteration of terrain or construction is the direct or proximate cause of a threatened loss of data, or does their protection extend to all instances where there is a threatened loss of data and there is activity which involves alteration of terrain? There can be no straight-forward resolution of the latter two issues because the Amendments are ambiguously worded, and different parts appear to support different conclusions. We rest our analysis wherever possible on the plain meaning of the statutory language; however, to resolve the ambiguities presented, it is necessary to consider what must have been the intent of Congress. For this task, the legislative history²²⁴ is a useful, though not totally illuminating guide.

²²⁰ 16 U.S.C. § 469 (1970).

²²¹ 16 U.S.C. § 469a-1 (Supp. V 1975).

²²² *Id.*

²²³ 16 U.S.C. § 469a-2 (Supp. V 1975).

²²⁴ H.R. REP. NO. 992, 93d Cong., 2d Sess. 5, reprinted in, [1974] U.S. CODE CONG. & AD. NEWS 3168.

There is, however, no ambiguity with respect to the first issue. By the explicit wording of the Amendments, they apply to "any Federal, federally assisted, or licensed project, activity or program."²²⁵ The regulatory power of the FCC is specifically designated as "licensing" by the Communications Act, while the functioning of the OTP is surely a "federal program or activity" within the meaning of the statutory language. Moreover, the intent of Congress, according to the legislative history, appears to have been that the Act be broadly construed. We cite the following quotations:

H.R. 296 would broaden and revise this program (protection of archeological and historical sites threatened by dam construction) by making it applicable to all Federal construction programs *and all programs licensed or otherwise assisted by Federal agencies*.²²⁶

The burdens imposed by H.R. 296 are not too severe. They require Federal agencies to be cognizant of historic and scientific values, to take them into account in the early planning processes, and to provide adequate time and funds for specific survey and salvage operations.²²⁷

As indicated, the proposal legislation expands the applicability of the program to all Federal agencies having construction projects. The proposed language, however is not limited to construction projects, *per se*, so that if a Federal agency finds or is made aware that any Federal program or federally assisted construction project or activity will cause the loss of scientific, prehistorical, historical, archeological, or paleontological data, then the agency must notify the Secretary of Interior of this fact and supply him with the information relevant to the matter.²²⁸

In addition, the letter from the General Counsel of Housing and Urban Development published in the legislative history²²⁹ requests clarification of what constitutes a "federally assisted" or "federally licensed project, activity or program," because this language is susceptible to a very broad interpretation. Such clarification was not made and this language was enacted into law. Discussion in the

²²⁵ 16 U.S.C. §§ 469, 469a-1, 469a-2 (Supp. V 1975).

²²⁶ H.R. REP. NO. 992, 93d Cong., 2d Sess. 5, *reprinted in*, [1974] U.S. CODE CONG. & AD. NEWS 3168, 3170 (emphasis added).

²²⁷ *Id.* at 5, [1974] U.S. CODE CONG. & AD. NEWS at 3171.

²²⁸ *Id.* at 7, [1974] U.S. CODE CONG. & AD. NEWS at 3172.

²²⁹ *Id.* at 15-17, [1974] U.S. CODE CONG. & AD. NEWS at 3180-82.

legislative history makes the point that the bill "seeks to cover *virtually all* Federal undertakings."²³⁰ Hence, there is no difficulty in applying the Amendments to all radio transmissions.

The second issue concerns not whether the radio signals which are objects of study for the passive services are scientific data, but whether scientific data of this nature are protected by the Amendments. It can be argued that Congress intended to protect only data of a historical, archeological, paleontological, or geological nature; in other words, only data buried in the ground. Certainly there are parts of the legislative history which suggest that this might be the case. However, other parts of the legislative history, and more importantly, the explicit wording of the statutes themselves, suggest otherwise. We believe that Congress intended to give comprehensive protection to data buried in the ground, but did not intend to limit this protection to such data; this is the only interpretation consistent with both the legislative history and the Amendments themselves.

In sections 469a-1 and 469a-2, of the Amendments²³¹ the categories of protected data are distinguished and labelled. They are: historical, archeological, prehistorical (paleontological) and scientific. Section 469²³² refers only to historical and archeological data, but modifies this reference with the parenthetical phrase "including relics and specimens." This suggests the Amendments were not intended to be limited in their application to relics and specimens only. Moreover, the law, as it existed before the Amendments, protected archeological and historical data, and the legislative history manifests an intent to broaden its coverage, to make federal agencies "cognizant of historic and scientific . . . values,"²³³ and to extend its application "to virtually all Federal undertakings."²³⁴ This purpose can be accomplished only if full effect is given to the language of sections 469a-1 and 469a-2. We submit that this language should be interpreted according to its plain meaning. Four kinds of data are carefully distinguished. Three of these are very par-

²³⁰ *Id.* at 6, [1974] U.S. CODE CONG. & AD. NEWS at 3171 (emphasis added).

²³¹ 16 U.S.C. §§ 469a-1, 469a-2 (Supp. V 1975).

²³² 16 U.S.C. § 469 (Supp. V 1975).

²³³ H.R. REP. NO. 992, 93d Cong., 2d Sess. 5, reprinted in, [1974] U.S. CODE CONG. & AD. NEWS 3168, 3171.

²³⁴ *Id.* at 6, [1974] U.S. CODE CONG. & AD. NEWS at 3171.

ticularly and narrowly defined classes of data. The fourth category is "scientific" data, and "scientific" is as general a term as could possibly have been chosen. If those who drafted the statute had meant to limit its application to scientific data buried in the ground, they surely could have chosen a more specific word that conveyed this meaning clearly. Had they meant "scientific" to denote a category of data less broad, such as geological data, they could have used "geological"; note again their careful delineation of "archeological," "historical," and "prehistorical." The doctrine of ejusdem generis seems precluded by the fact that in sections 469a-1 and 469a-2 "scientific" precedes the words "prehistorical, historical, archeological" and is not modified by the word "other." It appears to us that the word "scientific" implies a broad intent to protect scientific data, including that not buried in the ground. Electromagnetic radiation generated by agencies beyond the control of man and of importance for scientific studies is the very essence of scientific data; it seems to be protected by these Amendments.

The only remaining problem involves the possible necessity of an alteration of the terrain before the protection of the Amendments may be invoked. The previous law was strictly limited in its application to construction projects of particular kinds. Activities clearly covered by the new law are very much more diverse, but the statute still contains reference to alteration of terrain. There is reason to doubt that its continuation is deliberate. It appears only in section 469, which was changed but little by the 1974 legislation; there is no mention of alteration of terrain in sections 469a-1 and 469a-2. Since section 469 purports to describe the purpose of sections 469a-1 and 469a-2, we must conclude the statute gives no protection absent some alteration of terrain. The wording of sections 469a-1 and 469a-2, however, is sufficiently broad in its scope that it creates a real ambiguity concerning the degree to which alteration of terrain must be the proximate cause of harm to protected data. If we turn to the legislative history to resolve the ambiguity, we would argue that limiting protection against threatened harm to that proximately caused by alteration of terrain is not consistent with the intent expressed therein that the Amendments apply to "virtually all Federal undertakings," and that they not be limited to construction projects per se.²³⁵ The legislative his-

²³⁵ *Id.* at 6, 7, [1974] U.S. CODE CONG. & AD. NEWS at 3171, 3172.

tory, furthermore, contains other suggestions that the wording in section 469 is not evidence of a Congressional intent to require that alteration of terrain be a direct, proximate or immediate cause of a threat to protected data before such protection can be given effect. In particular, a letter from the Department of Agriculture emphasizes that section 469 could be broadly construed even without reference to sections 469a-1 and 469a-2:

That part of the proposed amendment . . . specifically, "any alteration of the terrain caused as a result of any Federal, federally assisted, or federally licensed activity or program" needs clarification as to the areas of applicability. As written, this provision could be construed as applying to essentially every activity of the Federal Government—defense, space, natural resources, agriculture, commerce and transportation, community development and housing, health, education, etc.—wherein Federal assistance, directly or indirectly, resulted in action altering the terrain.²³⁶

This objection was ignored and Congress passed the legislation unchanged. We believe therefore that Congress did not intend to require that alteration of terrain be the proximate cause of harm to scientific data.²³⁷

²³⁶ *Id.* at 14, [1974] U.S. CODE CONG. & AD. NEWS at 3180.

²³⁷ The wording of § 469 provides protection against data loss "as the result of . . . alteration of terrain." It does not say it must be proximately caused by alteration of terrain. One can advance arguments based both on statutory construction and on principles of physics that loss of scientific data as a result of radio-frequency interference may be deemed, within the meaning of § 469 to result from alteration of terrain. The statutory construction argument is that the Communications Act so intimately links construction of transmission facilities to actual transmissions that where the latter cause loss of scientific data, that loss may be deemed within the meaning of the Amendments, to result from the construction activity. This argument is based on § 308(a) of the Communications Act, which provides that a construction permit must be sought from the FCC, and this permit is required in addition to a frequency license. That a statute intended to prevent interference with radio reception requires specific licensing of construction projects is tantamount to Congressional recognition of the construction as the legal cause of the interference. This thesis is supported by the physical argument. The location of transmission facilities in one location may result in interference to them, but construction of that facility in another location could prevent the interference. Therefore it will often (and perhaps always) be the case that whether there will be interference depends upon *which* terrain is to be altered. Section 303(d) of the Communications Act provides that the FCC shall determine the location of transmitting stations; the FCC may enforce its determination by withholding a construction permit under § 308(a). We feel that this provides sufficient rationale for considering injury to the passive services through alteration of terrain, whatever importance Congress intended the wording of § 469 to have.

We conclude that the Amendments arguably apply to radio signals of scientific importance. Data in the form of radio signals can be "protected" by barring interfering transmissions on their frequency, and can be "recovered" and "preserved" in the literal, physical sense, by their detection and recollection with a radio telescope or other receiving apparatus. It would seem, therefore, that a frequency licensee might be barred from constructing transmission facilities which would interfere with one of the passive services until scientific observations of importance could be carried out, or until another frequency may be found for the potentially interference-causing transmission. The power conferred on the Secretary of Interior here would seem only to allow him to make the scientific observation which would constitute recovery and preservation of the data. The requirements of the Amendments, however, also apply directly to federal agencies such as the FCC and the OTP. Hence a party who would otherwise have standing to sue under the Administrative Procedure Act would have grounds to sue where one of the agencies failed to comply with these standards. Such suit could challenge the agency action which created the particular threat to scientific data.

If a more restrictive interpretation of the Amendments prevails, barring their direct applicability to radio interference, they are still evidence of the public policy in favor of the furtherance of scientific research which is determinative of the public interest with respect to radio spectrum management.

D. Regulation of Spurious Emissions

It is appropriate at this point to consider the problem of interference with the passive services as a result of spurious emissions. This is a problem of special importance to the passive services since they must detect weaker signals than must other services; however, it may be anticipated that, as the spectrum becomes increasingly crowded, other services will also experience trouble with spurious emissions. The same relief that is available to the passive services should also be available to them.

Spurious emission is regulated by the FCC on a service-to-service basis; technical standards are mandated for each broadcast service, and these include restrictions on the fraction of radiation which

may be emitted in bands other than that assigned to a licensee.²³⁸ Moreover, in recognition of the fact that passive services are more vulnerable to interference from spurious radiation than other services, some special protection provisions have been established by the FCC. In general, however, the FCC follows section 116A of the International Radio Regulations, which provides no greater protection for the passive services against spurious radiation than are received by any other telecommunications service.

Section 324 of the Communications Act requires that "all radio stations, including those owned and operated by the United States, shall use the minimum amount of power necessary to carry out the communications desired."²³⁹ Strictly speaking, no power at all is necessary in frequency bands outside of the one which is intended to be used for the transmission in question. As we have indicated,²⁴⁰ however, spurious emission outside of a licensee's assigned frequency band is an unavoidable consequence of the operation of physical laws, but can be reduced proportionately to the effort and expenditure the licensee is required to make. Financial sacrifice may legally be required of a licensee if it is in the public interest and does not spell destruction of a public service.²⁴¹ We believe, therefore, that the level of out-of-band power "necessary to carry out the communication desired" is the level below which further reduction would lead to economic losses for the licensee so severe that it would spell destruction or diminution of service to the public.²⁴² If section 324 is viewed as establishing a standard for the regulation of spurious emissions, by its wording that standard applies to the OTP as well as the FCC, and provides another basis for judicial review of OTP decisions.

Of course, if the passive services are not adequately protected against spurious radiation in their allocated bands, the allocation of such bands to them serves no purpose and is arguably arbitrary and capricious. The minimum power requirement of section 324,

²³⁸ See, e.g., 47 C.F.R. § 5.103 (1976), which prescribes spurious radiation standards for experimental radio services, and 47 C.F.R. §§ 73.682, .699 (1976) which serve the same function for television stations.

²³⁹ 47 U.S.C. § 324 (1970).

²⁴⁰ See Section II *supra*.

²⁴¹ See discussion Section I-A(1) *supra*.

²⁴² This is a direct application of the rationale of *Carroll Broadcasting v. FCC*, 258 F.2d 440 (D.C. Cir. 1958).

therefore, is not the only legal standard which governs spurious radiation. Wherever spurious radiation arising from the transmissions of one service makes impossible reception of signals by some other service in its allocated bands, the FCC must evaluate the public interest, convenience, and necessity with respect to the specific level of spurious radiation involved. In this evaluation it must take into account the public policy in favor of the furtherance of scientific progress, and the requirements of environmental legislation. Moreover, with respect to the allowable level of spurious radiation, the OTP, though it is bound by no public interest standard, is bound by any explicit or implicit requirements of environmental legislation relevant to the passive services.

E. Summary

We have in this section discussed the standards which govern frequency allocation to the passive services. We have considered the meaning of "public interest, convenience, or necessity," and sought to interpret its application to the passive services in the light of federal science policy. We have also examined other standards set by the Communications Act and discussed legislation outside the telecommunications area that appears to protect scientific research interests. Our principal conclusions may be summarized as follows:

1. There are three principal areas that may be said to comprise the public interest as defined by telecommunications case law. These are (a) conformity with both the specific requirements and general purposes of the Communications Act of 1934 and, where applicable, with the Communications Satellite Act of 1962; (b) principles of telecommunications policy that are derived from the use of the word "public" to delineate those interests which are paramount; and (c) public policy in its broadest sense.

2. The "necessity" of which telecommunications law speaks may be defined, at least in so far as frequency allocation is concerned, in terms of the feasibility of a desired user operating in one part of the spectrum as opposed to some other part. This is public necessity because it is the express policy of the Communications Act and the Communications Satellite Act to maximize efficiency of spectrum usage.

3. Public interest and necessity mandate that, with respect to

frequency allocation, the passive services be given a limited preference. The reasons for this conclusion span the categories of public interest and necessity that we have defined and number five: (a) the passive services represent an interest of part of the community; (b) the passive services exist not for any motive of financial profit to some business enterprise, but for the benefit of all citizens through the enrichment of public knowledge and the furtherance of scientific progress; (c) no rationing of passive services, *inter se*, is required as all may share equally; (d) the size and location of frequency bands required for the passive services is generally a matter of necessity, mandated by laws of physics over which man has no control; and (e) there exists a public policy in favor of the promotion of scientific investigations, which is grounded in the Constitution and expressed in numerous enactments of the Congress.

4. The National Environmental Policy Act of 1969 and the 1974 Amendments to the Historic Sites Act of 1935 may protect the radio signals studied by the passive services from interference by transmissions licensed or otherwise made pursuant to Federal authority. An effect of this would be that where important interests of the passive services are involved, these acts mandate legal standards that remove frequency allocation decisions by the OTP from the area of "agency action committed to agency discretion." Therefore, such decisions are subject to judicial review by federal courts under the Administrative Procedure Act.

5. Spurious emission should be regulated by both the FCC and the OTP in accordance with section 324 of the Communications Act of 1934, which we believe requires the lowest level of out-of-band radiated power which may be achieved without requiring a licensee to suffer economic loss so serious that the public will be deprived of service. Furthermore, spurious emission levels may not be so high as to prevent a service from receiving signals in bands allocated to it.

VI. JUDICIAL REVIEW AND THE PASSIVE SERVICES

This article would be incomplete without a brief exploration of the availability of judicial relief to the passive services in the event that their interests should be compromised by the frequency man-

agement agencies. We are primarily concerned with the circumstances under which individual scientists and research institutions, including government agencies, would have standing to seek judicial review of FCC and OTP decisions. We note, however, that rarely would an individual scientist have the financial resources to support a lawsuit, while even research institutions, since they earn no profit, might find it difficult to protect their interests in court.

The United States and, therefore, both the FCC and the OTP, may not be sued without its consent. Two statutes provide such consent. These are the Communications Act, and the Administrative Procedure Act.²⁴³ Under the Communications Act, appeal may be taken from decisions and orders of the FCC by any person aggrieved only as a result of award or denial of a license or other permit by the Commission.²⁴⁴ Any party whose interests are adversely affected by a frequency-allocation decision may not seek judicial review of that decision, but must challenge individually every frequency license granted pursuant to it. Since members of the passive services cannot seek licenses of their own, but must depend on allocations for protection, this would make it extremely difficult for them to obtain relief in the event of arbitrary FCC action. The Administrative Procedure Act, however, provides a much broader consent and allows frequency-allocation decisions to be challenged directly.

Any "person suffering legal wrong because of agency action, or adversely affected or aggrieved by agency action within the meaning of a relevant statute, is entitled to judicial review thereof."²⁴⁵ "Agency action" includes the whole or part of an agency rule, order, sanction, relief, or the equivalent, or denial thereof, or failure to act."²⁴⁶ Any institution or individual which suffers any injury that is recognized by some statute, or any other legal injury, on account of any agency decision, or the failure of an agency to make a decision, may seek judicial review. Furthermore, this consent extends to essentially all agencies of the federal government,²⁴⁷ and includes

²⁴³ See note 62 *supra*.

²⁴⁴ 47 U.S.C. § 402(b) (1970).

²⁴⁵ 5 U.S.C. § 702 (1970 & Act of Oct. 31, 1976, Pub. L. No. 94-574, 90 Stat. 2721).

²⁴⁶ *Id.* § 551(13) (1970).

²⁴⁷ *Id.* § 701(b).

the FCC, the President and the OTP, and all executive departments. A party aggrieved as a result of a frequency allocation may challenge that decision directly. We have already noted, however, that "agency action committed to agency discretion by law" is immune from judicial review,²⁴⁸ and therefore decisions of the OTP and the State Department which affect frequency allocations are not ordinarily subject to challenge.²⁴⁹ The one exception to this is where interests of the passive services which are protected by environmental legislation are involved. These laws provide legal standards which are non-discretionary in their application²⁵⁰ and, if relevant, serve to make frequency-allocation decisions of the OTP subject to judicial review. We note again²⁵¹ that courts are reluctant to consider any challenges to an agency decision which appears to be a request that they make a redetermination of a factual matter in which the agency has special competence.

There remains, however, the question of who has standing to complain should there be a frequency allocation or other decision which would adversely affect scientific research. The rule which governs this issue was enunciated in *Sierra Club v. Morton*,²⁵² which involved a suit to block private development of federal land adjacent to a national park by an environmental organization that claimed standing as a party aggrieved by agency action under section 702 of the Administrative Procedure Act. The case was dismissed without consideration of its merits because neither the organization nor its members had anything more at stake than a general interest in conservation. The court held that although Congress might grant standing to whomever it chose provided a genuine case or controversy existed, the Administrative Procedure Act did not modify the traditional rule that a party suffer particular injury before he will be heard by a court. Such injury need not be economic in nature, but must be personal to plaintiff and therefore different from any which may be suffered by the public in general. Once standing is established, however, the public welfare may be

²⁴⁸ *Id.* § 701(a).

²⁴⁹ See Section III *supra*.

²⁵⁰ *Environmental Defense Fund v. Tennessee Valley Authority*, 468 F.2d 1164 (6th Cir. 1972).

²⁵¹ See note 162 *supra*.

²⁵² 405 U.S. 727 (1972).

asserted with respect to the merits of the case.

Given this rule, we believe that individual scientists, as well as institutions devoted to scientific research, have standing to challenge frequency-management agency decisions where their own research interests are directly affected. As we have repeatedly noted, the general public is injured as a result of any interference with scientific research. That injury is the ultimate denial to the public of the benefits which may result from increased human knowledge. The individual who actually would do the research suffers a different and more particular harm: interference with his ability to pursue his professional livelihood. Arguably individuals or institutions whose research interests are affected by frequency-allocation decisions have standing to challenge them in court because of this interference.²⁵³

It should be noted, however, that it is only the frequency management agency which may be sued. The spectrum user whose transmissions would cause the injurious interference has a complete defense if he transmits pursuant to a license issued by appropriate federal authority. There is but one exception to this rule, and it involves communications satellite systems.

The Communications Satellite Act²⁵⁴ authorizes the Attorney General of the United States to petition a district court of the United States for such equitable relief as may be necessary or appropriate to prevent or terminate any conduct or threat of conduct by the Communications Satellite Corporation or any other person which would be inconsistent with the policies and purposes declared in section 701 of that Act; these include a requirement of economical and efficient spectrum usage.²⁵⁵ Satellite systems may operate at any frequency at all within a very wide range. It is the very essence of efficiency of spectrum usage that engineering studies which design them should engineer them not only to operate at frequencies at which the spurious radiation they generate will cause the least injury to other services, but also to generate the least possible amount of spurious radiation. In particular, the protection

²⁵³ The Supreme Court has long recognized that one's right to pursue a profession is a liberty which may not be denied without due process of law. *Meyer v. Nebraska*, 262 U.S. 390, 400 (1922); *Truax v. Raich*, 239 U.S. 33, 41 (1915).

²⁵⁴ 47 U.S.C. § 743 (1970).

²⁵⁵ See S. REP. NO. 1587, 87th Cong., 2d Sess. 8, reprinted in, [1962] U.S. CODE CONG. & AD. NEWS 2269, 2270, quoted at note 61 *supra*.

needs of the passive services must be considered since they are vulnerable to lower power levels of interfering radiation than other services and because they have little or no freedom to operate outside of the narrow bands selected for them by the laws of nature. This responsibility rests as much on the operator of a satellite system as it does on the FCC. Comsat or any other telecommunications corporation is likely to have available to it greater expertise than a federal regulatory agency. Very often the FCC, when presented with a plan for a specific satellite system, might have no choice but either to approve it in full or to reject it. Reengineering might not be feasible, nor might the commission know what degree of re-engineering might be possible. Furthermore, section 743 of the Communications Satellite Act evidences a congressional intent that Comsat and other private parties should themselves bear responsibility for ensuring that the policies and purposes of section 701 are effected. Therefore we conclude that designers and operators of communications satellite systems have an affirmative responsibility to ensure that they make use of the radio spectrum in an efficient and economical manner, and especially that they will not cause avoidable interference to the passive services. Where this responsibility is not met, the Attorney General may seek in court appropriate relief.

That individual spectrum users may not be sued on account of their transmissions pursuant to a valid federal license is important for one other reason. It makes it possible for a government agency, such as NOAA or NASA, which uses the radio spectrum for passive scientific research, or for any other purpose, to seek judicial review of an FCC decision adversely affecting such use. This rule is established over the claim of identity of parties to the suit by several cases, including *United States v. ICC*²⁵⁶ and *United States v. Nixon*.²⁵⁷ It is stated as follows, "the mere assertion of a claim of 'intra-branch' dispute [does not] defeat federal jurisdiction."²⁵⁸ To decide whether there is jurisdiction, "courts must look behind names that symbolize the parties to determine" whether there is a real dispute and who are the true parties in interest.²⁵⁹ In *United*

²⁵⁶ 337 U.S. 426 (1949).

²⁵⁷ 418 U.S. 683 (1974).

²⁵⁸ *Id.* at 693.

²⁵⁹ *Id.*; *United States v. ICC*, 337 U.S. 426, 430 (1949).

*States v. ICC*²⁶⁰ the real parties in interest were the United States, as a shipper in interstate commerce, and certain railroads. The dispute concerned an order of the ICC which denied the government a recovery in damages for exaction of an allegedly unlawful railroad rate. In *United States v. Nixon*²⁶¹ the real parties in interest were the United States, as prosecutor in a criminal case, and Richard Nixon, an individual who believed he did not have to surrender certain evidence pursuant to a subpoena duces tecum. If a situation should arise in which the FCC had allocated certain frequency bands or made some other decision which prejudiced the ability of a federal agency to pursue its Congressional mandate, the real parties in interest would be the United States, as radio spectrum user, and the private or commercial interest for whose benefit the FCC decision had been made. The private party being immune from suit, the United States could have no remedy but against the FCC, and it is precisely this remedy which is allowed by the precedents cited.

By the same logic, a federal agency could not seek judicial review of a decision of the OTP. That agency acts for the benefit of no private or commercial parties, but only for that of other government departments. The aggrieved agency could appeal to the President, who has final authority over government spectrum usage under the Communications Act,²⁶² but the courts would be closed to it.

VIII. CONCLUSIONS

We have completed our exploration of the frequency allocation problem with respect to the passive services. Our principal conclusion is that the requirement²⁶³ that frequency allocation be governed by "public interest, convenience, or necessity" mandates that both federal science policy and the special character of the passive services be considered by the FCC in all frequency allocation decisions which may affect the passive services. The frequency management powers of the OTP and the State Department, however, may make it difficult or impossible for the FCC to act as Congress

²⁶⁰ 337 U.S. 426 (1949).

²⁶¹ 418 U.S. 683 (1974).

²⁶² 47 U.S.C. § 305 (1970).

²⁶³ 47 U.S.C. § 303(c) (Supp. V 1975).

intended it should; this situation threatens harm to all spectrum users, but may be especially serious for economically weak groups such as the passive services. Although judicial relief may be available to the passive services even against the OTP, such relief is expensive and subject to the uncertainties which beset all litigation.

Congress could greatly improve this situation by revising section 323 of the Communications Act, as we have suggested.²⁶⁴ That, plus judicial awareness of the motivation for specific international agreements, would solve the multiple authority problem. We would recommend that Congress do more. The Communications Act is now more than forty years old, and many of its provisions were originally part of the Radio Act of 1927. It is especially a law written to govern use of the spectrum by essentially one type of user—the radio broadcaster. We think that Congress should consider revising the Act and incorporating into it new standards which will more clearly define the important considerations with respect to frequency allocations and assignments to services and individuals of greatly differing character. Certainly it would be appropriate to provide special criteria for the allocation of bands to passive scientific research; for example Congress could explicitly require the FCC and the President to investigate the need for the use of particular frequency bands for research and to set these bands aside for that purpose, absent compelling reasons of public interest in favor of some other use. There is a danger here: if Congress should try specifically to address the particular needs of every service, it could create an administrative nightmare for the FCC and for spectrum users. The great virtue of the Communications Act as it is presently written is the flexibility it provides. In an era of rapid technological evolution, Congress should allow frequency management agencies the ability to change the basis for their decisions, when new circumstances require such change. This does not mean that Congress should attempt to provide no special guidance at all to the frequency management agencies when they must deal with widely different uses of the spectrum, and especially with respect to a matter of such great public importance as scientific research.

²⁶⁴ See Section III-B *supra*.